



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

B

814,787



M



M



M



M



M



M



M



LIBRARIES

LIBRARY OF

M



M



M



M



M



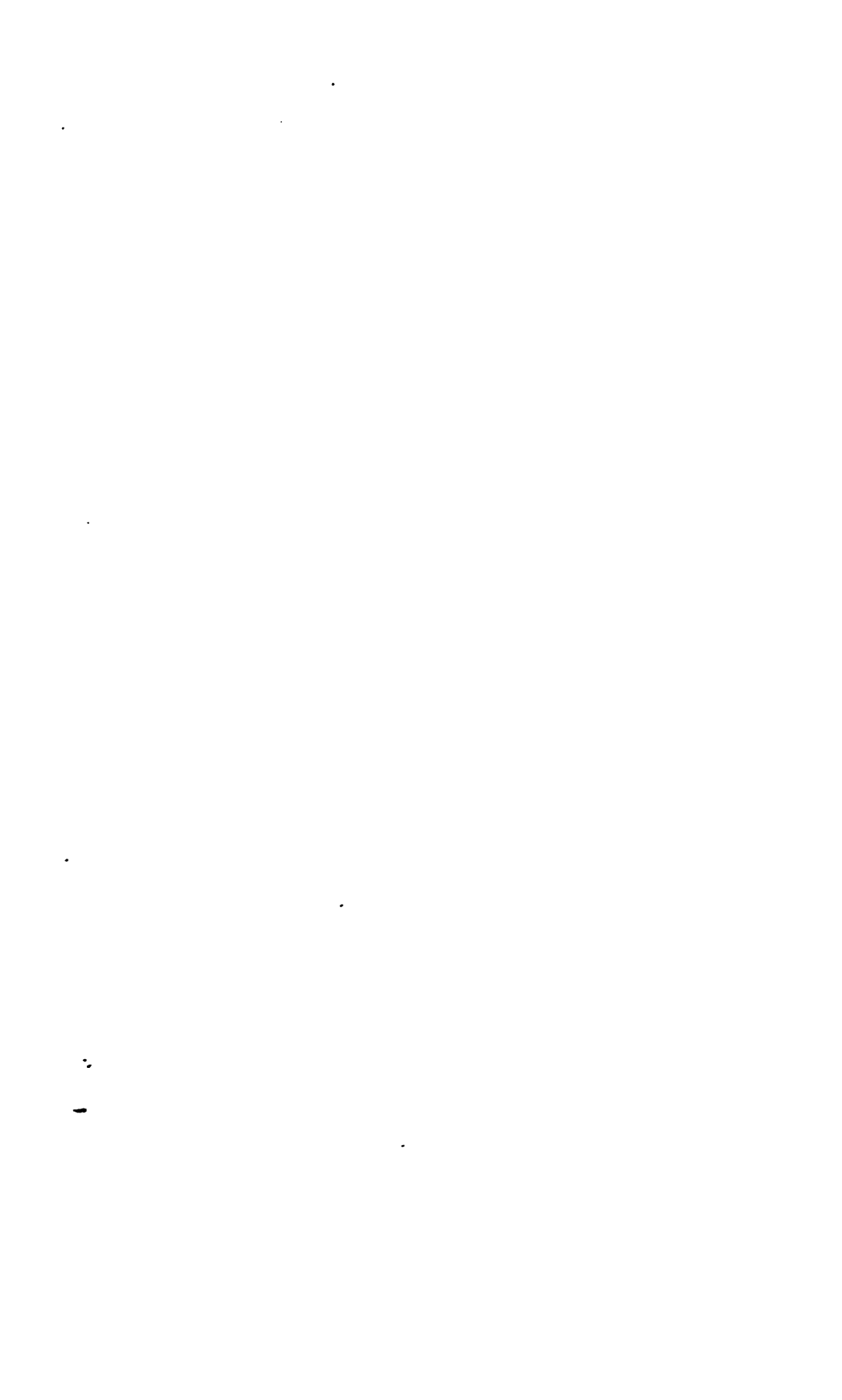
M



M



M



✓
415
.H3
1874-82

ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

AT

ANNAPOLIS, MD.

TWENTY-FIFTH ACADEMIC YEAR,

1874-75.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1874.

✓
415
.H3
1874-82

ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

AT

ANNAPOLIS, MD.

TWENTY-FIFTH ACADEMIC YEAR,

1874-75.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1874.



CONTENTS.

HISTORICAL SKETCH	3
BOARD OF VISITORS	4
CALENDAR, 1874-'75	5
OFFICERS	7
ACADEMIC BOARD	10
CADET-OFFICERS	11
CADETS, WITH RELATIVE STANDING IN CLASSES	13
NUMERICAL SUMMARY	26
RESIGNATIONS AND DISMISSALS	27
PRACTICE-CRUISE, 1874	29
MERIT-ROLLS, 1873-'74	31
REQUISITES FOR ADMISSION	45
COURSE OF INSTRUCTION	60
PROGRAMME OF STUDIES	64
EXAMINATION-PAPERS, 1873-'74	67
INDEX	117

THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The School at its establishment numbered 56 Midshipmen, of whom 36, of the date of 1840, were preparing for examination; 13, of the date of 1841, were to remain at their studies until ordered to sea; and 7, just appointed, were to take the regular course, which was fixed as one year at the School, three years at sea, and a fifth and final year at the School, before promotion. Later, the course was altered to seven years, of which the first two and last two were at the School, and the intervening years at sea.

In October, 1849, a board of officers was appointed to re-organize the School. A new system was devised and carried into operation, July 1, 1850. By this, the course of instruction was made more extensive, and arranged to cover four consecutive years; the corps of Professors was increased, and a Sloop-of-war, the *Preble*, was attached to the School as a practice-ship. The new school was called the Naval Academy, and was placed under the supervision of the Chief of the Bureau of Ordnance and Hydrography. A board of visitors was appointed to examine into the state of the Academy annually, and to make a report upon its condition to the Secretary of the Navy. The first class of Acting Midshipmen under the four years' course entered in October, 1851, and was graduated in June, 1854. The previous course was retained for all who had entered the service before this time, those of the date of 1850 being graduated in 1856.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and those remaining were quartered in the Atlantic House, and on board the *Frigate Constitution*. In September, 1865, the Academy was restored to Annapolis, where it has since remained.

On the establishment of the Bureau of Navigation, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. This system was followed till March 11, 1869, when all connection with the Bureau ceased.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class was graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and was graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy last summer. By an act of Congress, approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years, instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

There are, therefore, three classes of Cadet-Engineers now at the Academy: the First, which entered in 1873, and which will be graduated in due course in 1875; the Second, composed of Cadets turned back from the First Class on account of deficiency in scholarship, and whose course ends in 1876; and the Fourth Class, just admitted by competitive examination, which will be graduated under the four years' rule in June, 1878.

BOARD OF VISITORS, JUNE, 1874.

Rear Admiral WILLIAM REYNOLDS, U. S. N., *President*.
Hon. AARON A. SARGENT, United States Senate, *Vice-President*.
Hon. JOHN W. STEVENSON, United States Senate.
Hon. EUGENE HALE, United States House of Representatives.
Hon. L. Q. C. LAMAR, United States House of Representatives.
General JOHN GIBBON, U. S. A.
Hon. L. E. PARSONS, of Alabama.
Hon. J. P. VINCENT, of Pennsylvania.
Hon. WILLIAM E. AIKEN, of South Carolina.
Rev. J. L. G. MCKOWN, of Illinois.
General J. H. WILSON, of New York.
General W. H. MORGAN, of Missouri.
Col. D. P. DYER, of Missouri.
Capt. S. B. LUCE, U. S. N.
Chief Engineer W. H. SHOCK, U. S. N.

CALENDAR.

1874-75.

1874.

June 5.—Examination of candidates for admission as Cadet-Midshipmen began	Friday.
June 15.—Examination of candidates concluded	Monday.
July 4.—Holiday	Saturday.
Sept. 15.—Examination of candidates for admission as Cadet-Engineers began	Tuesday.
Sept. 18.—Examination of candidates for admission as Cadet-Engineers concluded	Friday.
Sept. 21.—Examination of candidates for admission as Cadet-Midshipmen began	Monday.
Sept. 30.—Examination of candidates for admission as Cadet-Midshipmen concluded	Wednesday.
Oct 1.—First Term began	Thursday.
Nov. 26.—Thanksgiving: studies, recitations, exercises, and duty suspended	Thursday.
Dec. 25.—Christmas: studies, recitations, exercises, and duty suspended. 1875.	Friday.

Jan. 1.—New Year's Day: studies, recitations, exercises, and duty suspended	Friday.
Jan. 25.—Semi-annual examination begins	Monday.
Jan. 30.—Semi-annual examination concluded. First Term ends	Saturday.
Feb. 1.—Second Term begins	Monday.
Feb. 22.—Holiday	Monday.
May 20.—Annual examination begins	Thursday.
May 30.—Annual examination concluded. Second Term ends	Monday.

PRACTICE CRUISE.

JUNE—SEPTEMBER, 1875.

June 5.—Examination of candidates for admission as Cadet-Midshipmen begins	Saturday.
June 8.—Examination of candidates for admission ends	Tuesday.
Sept. 15.—Examination of candidates for admission as Cadet-Engineers.	Wednesday.
Sept. 20.—Examination of candidates for admission as Cadet-Midshipmen begins	Monday.
Sept. 23.—Examination of candidates for admission as Cadet-Midshipmen ends	Thursday.
Oct. 1.—First Term (1875-76) begins	Friday.

CALENDAR FOR 1874-75.

OCTOBER.							APRIL.						
S.	M.	T.	W.	T.	F.	S.	S.	M.	T.	W.	T.	F.	S.
.....	.....	.....	.....	1	2	3	.....	.....	.....	.....	1	2	3
4	5	6	7	8	9	10	4	5	6	7	8	9	10
11	12	13	14	15	16	17	11	12	13	14	15	16	17
18	19	20	21	22	23	24	18	19	20	21	22	23	24
25	26	27	28	29	30	31	25	26	27	28	29	30	.....
NOVEMBER.							MAY.						
1	2	3	4	5	6	7	.....	.....	.....	.....	.....	.....	.....
8	9	10	11	12	13	14	2	3	4	5	6	7	8
15	16	17	18	19	20	21	9	10	11	12	13	14	15
22	23	24	25	26	27	28	16	17	18	19	20	21	22
29	30	.....	.....	.....	.....	.....	23	24	25	26	27	28	29
.....	.....	.....	.....	.....	.....	.....	30	31	.....	.....	.....	.....	.....
DECEMBER.							JUNE.						
.....	.....	1	2	3	4	5	.....	.....	1	2	3	4	5
6	7	8	9	10	11	12	6	7	8	9	10	11	12
13	14	15	16	17	18	19	13	14	15	16	17	18	19
20	21	22	23	24	25	26	20	21	22	23	24	25	26
27	28	29	30	31	.....	.....	27	28	29	30	.....	.....	.....
JANUARY.							JULY.						
.....	.....	.....	.....	.....	1	2	.....	.....	.....	.....	1	2	3
3	4	5	6	7	8	9	4	5	6	7	8	9	10
10	11	12	13	14	15	16	11	12	13	14	15	16	17
17	18	19	20	21	22	23	18	19	20	21	22	23	24
24	25	26	27	28	29	30	25	26	27	28	29	30	31
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
FEBRUARY.							AUGUST.						
.....	1	2	3	4	5	6	1	2	3	4	5	6	7
7	8	9	10	11	12	13	8	9	10	11	12	13	14
14	15	16	17	18	19	20	15	16	17	18	19	20	21
21	22	23	24	25	26	27	22	23	24	25	26	27	28
28	.....	.....	.....	.....	.....	.....	29	30	31	.....	.....	.....	.....
MARCH.							SEPTEMBER.						
.....	1	2	3	4	5	6	.....	.....	.....	.....	.....	.....	.....
7	8	9	10	11	12	13	5	6	7	8	9	10	11
14	15	16	17	18	19	20	12	13	14	15	16	17	18
21	22	23	24	25	26	27	19	20	21	22	23	24	25
28	29	30	31	.....	.....	.....	26	27	28	29	30	.....	.....

OFFICERS
OF THE
UNITED STATES NAVAL ACADEMY.

REAR-ADMIRAL
CHRISTOPHER RAYMOND PERRY RODGERS,
SUPERINTENDENT.

ACADEMIC STAFF.

CAPTAIN KIDDER RANDOLPH BREESE,
Commandant of Midshipmen,
and
Head of the Departments of Seamanship and of Ordnance and Gunnery.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER FREDERICK VALLETTE McNAIR,
Assistant to Commandant of Midshipmen,
and
Senior Instructor in Seamanship, Naval Tactics, and Naval Construction.

LIEUTENANT-COMMANDER PHILIP HENRY COOPER,
LIEUTENANT-COMMANDER COLBY MITCHELL CHESTER,
LIEUTENANT-COMMANDER HENRY CHAMPLIN WHITE,
LIEUTENANT EUGENE DE FOREST HEALD,
Assistants to Commandant of Midshipmen,
and
Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,
Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER EDWARD TERRY,
Assistant to Commandant of Midshipmen,
and
Senior Instructor in Naval Gunnery and Infantry Tactics.

LIEUTENANT-COMMANDER ALBERT GALLATIN CALDWELL,
LIEUTENANT-COMMANDER BOWMAN HENDRY McCALLA,
LIEUTENANT SIDNEY AUGUSTUS SIMONS,
LIEUTENANT CHARLES CARPENTER CORNWELL,
Assistants to Commandant of Midshipmen,
and
Instructors in Naval Gunnery and Infantry Tactics.

A. J. CORBESIER,
Sword-Master.

J. B. RETZ,
GEORGE HEINTZ,
Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR WILLIAM WOODBURY HENDRICKSON,
Head of Department.

LIEUTENANT-COMMANDER CHARLES WILLIAM KENNEDY,
LIEUTENANT-COMMANDER FRENCH ENSOR CHADWICK,
LIEUTENANT-COMMANDER SAMUEL HOUSTON BAKER,
LIEUTENANT WILLARD HERBERT BROWNSON,
LIEUTENANT ASA WALKER,
LIEUTENANT CHARLES STILLMAN SPERRY,
ASSISTANT PROFESSOR FOSTER ELLENBOROUGH LASCELLES BEAL, S. B.,
Instructors in Mathematics.

STEAM-ENGINEERY.

CHIEF ENGINEER CHARLES HENRY BAKER,
Head of Department.

PASSED ASSISTANT ENGINEER THOMAS WHITESIDE RAE,
PASSED ASSISTANT ENGINEER JOHN LIVINGSTON DINWIDDIE BORTHWICK, M. A.
PASSED ASSISTANT ENGINEER GEORGE EDWARD TOWER,
PASSED ASSISTANT ENGINEER DAVID JONES,
PASSED ASSISTANT ENGINEER CHARLES HENRY MANNING,
ASSISTANT ENGINEER CHARLES WHITESIDE RAE, C. E.,
Instructors in Steam-Enginery.

ASTRONOMY, NAVIGATION, AND SURVEYING.

LIEUTENANT-COMMANDER ALEXANDER HUGH McCORMICK,
Head of Department.

LIEUTENANT-COMMANDER PURNELL FREDERICK HARRINGTON,
LIEUTENANT RAYMOND PERRY RODGERS,
Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

COMMANDER WILLIAM THOMAS SAMPSON,
Head of Department.

LIEUTENANT-COMMANDER ALBERT SMITH BARKER,
LIEUTENANT-COMMANDER SILAS WRIGHT TERRY,
PROFESSOR NATHANIEL MATSON TERRY, A. M., PH. D.,
PROFESSOR CHARLES EDWARD MUNROE, S. B.,
Instructors in Physics and Chemistry.

PROFESSOR JOHN MINOT RICE, S. B.,
LIEUTENANT MORRIS ROBINSON SLIDELL MACKENZIE,
Instructors in Applied Mathematics and Mechanics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR JAMES RUSSELL SOLEY, A. B.,
Head of Department.

LIEUTENANT CHARLES BELKNAP,
LIEUTENANT EDWARD PARKER WOOD,
ASSISTANT PROFESSOR WILLIAM WIRT FAY, A. M.,
ASSISTANT PROFESSOR FREEMAN SNOW, A. B.,
ASSISTANT PROFESSOR ELIOT LORD, A. B.,
Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

COMMANDER WINFIELD SCOTT SCHLEY,
Head of Department.

LIEUTENANT-COMMANDER JOHN SCHOUER,
ASSISTANT PROFESSOR PEDRO MONTALDO,
Instructors in Spanish.

PROFESSOR LUCIEN FRANKLIN PRUD'HOMME,
 ASSISTANT PROFESSOR ALPHONSE V. S. COURCELLE,
 ASSISTANT PROFESSOR EUGENE DOVILLIERS,
 ASSISTANT PROFESSOR JULES LEROUX,
 ASSISTANT PROFESSOR HIPPOLYTE DALMON,
Instructors in French.

DRAWING.

PROFESSOR RICHARD SOMERS SMITH, A. M.
Head of Department.

ASSISTANT PROFESSOR MARSHAL OLIVER,
 ASSISTANT PROFESSOR CHARLES FRANCIS BLAUVELT, N. A.,
Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

COMMANDER NORMAN VON HELDREICH FARQUHAR, *in charge of Vessels.*
 COMMANDER SAMUEL DANA GREENE, *in charge of Grounds.*
 PAY-INSPECTOR JAMES DANIEL MURRAY.
 PAYMASTER SAMUEL TRACEY BROWNE, *Storekeeper.*
 SURGEON GEORGE ADAMS BRIGHT, M. D.
 ACTING PASSED ASSISTANT SURGEON JOSEPH JOHN SOWERBY, M. D.
 ACTING ASSISTANT SURGEON THOMAS OLIVER WALTON, M. D.
 CHAPLAIN JOHN RUTHERFORD MATTHEWS, M. A.
 ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
 JAMES JOHNSON GRAFF, *Assistant Librarian.*
 RICHARD SWANN, *Commissary.*
 RICHARD MOALE CHASE, *Secretary.*

JAMES G. GLYNN, *First Clerk.*
 SAMUEL JICKLING, *Second Clerk.*
 OWEN DORSEY ROBB, *Third Clerk.*
 CHARLES MARION MCLEOD, *Clerk to Commandant of Midshipmen.*

MARINE GARRISON.

CAPTAIN McLANE TILTON, *Commanding.*
 FIRST LIEUTENANT HENRY CLAY COCHRANE.
 FIRST LIEUTENANT DANIEL PRATT MANNIX.
 FIRST LIEUTENANT SAMUEL KUYPERS ALLEN.
 SECOND LIEUTENANT SAMUEL HOPPER GIBSON.

MATES.

C. J. MURPHY.....	}	<i>Attached to the United States Gunnery-ship Santee, and to the Sloop-of-war Dale.</i>
WILLIAM G. SMITH.....		
L. M. MELCHER.....		
T. W. BONNALL.....		
ROBERT SILVER.....	}	<i>Attached to the United States Steamer Lehigh, (iron- clad.)</i>
BENJAMIN G. PERRY.....		
JOSEPH RODGERS.....		

*Attached to the United States Steamer Phlox, (steam-
tender.)*

ACADEMIC BOARD.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N.
CAPTAIN K. R. BREESE, U. S. N.
COMMANDER EDWARD TERRY, U. S. N.
COMMANDER F. V. McNAIR, U. S. N.
COMMANDER W. S. SCHLEY, U. S. N.
COMMANDER W. T. SAMPSON, U. S. N.
CHIEF ENGINEER C. H. BAKER, U. S. N.
LIEUTENANT-COMMANDER A. H. McCORMICK, U. S. N.
PROFESSOR W. W. HENDRICKSON, U. S. N.
PROFESSOR R. S. SMITH, A. M.
PROFESSOR J. R. SOLEY, A. B.

CADET-OFFICERS.

CADET LIEUTENANT-COMMANDER.

CAMERON M. WINSLOW.

CADET-LIEUTENANTS.

ALBON C HODGSON.
WALTER S. HUGHES.JAMES M. HELM,
FYDELIO S. CARTER.

CADET-MASTERS.

CHARLES H. AMSDEN.
ALEXANDER SHARP.HENRY J. HUNT,
RICHARD H. TOWNLEY.

CADET-ENSIGNS.

WILLIAM B. CAPEERTON.
DAVID DANIELS.HARRY M. HODGES.
RIDGELY HUNT.

CADET PETTY-OFFICERS.

*First Captains of Guns' Crews.*Edward D. Bostick.
William G. Cutler.
Alfred L. Howe.
Harry H. Hosley.
Charles Laird.
Charles M. McCartney.John A. Shearman.
James T. Smith.
George Stoney.
Nathaniel R. Usher.
Frederick B. Vinton.Augustus E. Jardine.
Stimson J. Brown.
Henry C. Gearing.
Templin M. Potts.
George C. Foulk.*Second Captains of Guns' Crews.*Clarence A. Corbin.
Frederick W. Coffin.
Robert N. Doyle.
Frank F. Fletcher.
George H. Worcester.
Burns T. Walling.James H. Sears.
William H. Allen.
Walter McLean.
Charles C. Rogers.
Clifford J. Boush.Stephen Jenkins.
John T. Newton.
Thomas G. Winch.
Lovell K. Reynolds.
William L. Varnum.

ENGINEER DIVISION.

CADET PETTY-OFFICERS.

First Class.

William Cowles.

Frank H. Eldridge.

William R. King.

Second Class.

George S. Willits.

Walter F. Worthington.

Frank H. Bailey.

CADET-MIDSHIPMEN

AND

**CADET-ENGINEERS ON PROBATION AT THE NAVAL
ACADEMY,**

WITH THEIR

RELATIVE STANDING

AS DETERMINED AT THE

ANNUAL EXAMINATION IN MAY, 1874;

TOGETHER WITH

THE GRADUATING CLASSES OF 1874.

MIDSHIPMEN.

Graduating Class—30 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.										Number of Demerits.		Sea-service.	
				Years.	Months.	Seamanship.	Practical exercises	Gunnery.	Fencing.	Steam.	Navigation.	Heut.	Light.	Law.	Spanish.			Months.	Days.
17	Alderlice, Winslow	Virginia	June 17, 1870	16		17	27	16	21	10	21	11	21	18	30		94	6	26
21	Arma, Lyman	Michigan	Sept. 24, 1870	16	10	7	14	15	3	16	26	20	17	15	14		141	6	26
26	Bowyer, John Marshall	Iowa	Sept. 28, 1870	17	3	4	2	19	19	12	28	12	24	8	17		21	6	26
12	Colwell, John Charles	At large	Sept. 22, 1870	14	1	18	10	13	27	11	16	10	26	17	16		131	6	26
30	Danner, Frederick William	Alabama	June 23, 1869	17	7	25	4	26	7	27	30	28	30	23	24		140	13	14
15	Dorn, Edward John	Missouri	Sept. 21, 1870	16	8	13	8	14	16	14	24	18	15	4	12		44	10	15
22	Emmons, George Thornton	At large	June 4, 1870	17	11	29	15	25	14	21	28	25	14	9	26		49	6	26
25	Farnsworth, John	Illinois	Sept. 25, 1869	14	0	26	28	29	15	30	15	23	11	29	19		122	11	15
2	Fiske, Bradley Allen	Ohio	Sept. 22, 1870	16	3	9	24	4	4	8	4	3	4	2	4		93	6	26
7	Flynn, Lucian	Texas	Sept. 22, 1870	15	10	12	24	2	11	4	1	4	2	5	1		98	6	26
16	Fuller, Edward Chapman	Ohio	Sept. 27, 1870	17	11	21	19	12	12	1	18	8	27	24	29		142	6	26
23	Haskell, Charles William	Iowa	June 23, 1870	16	10	27	18	10	21	25	25	19	28	13	26		84	6	26
3	Holmes, Frank Huntington	California	June 29, 1870	17	9	1	12	5	25	3	8	2	9	10	25		77	6	26
8	Hutchins, Hamilton	New Hampshire	June 23, 1870	15	6	6	5	18	25	7	6	13	10	21	5		140	6	26
18	Intter, George Edward	Virginia	June 21, 1870	17	3	9	10	20	24	17	11	17	19	14	20		53	6	26
22	Milligan, Frank John	Tennessee	June 29, 1869	16	6	20	16	11	29	20	22	30	23	16	22		66	12	6
27	Nicolson, John Ormond	Alabama	June 29, 1869	16	4	22	30	28	30	29	27	29	15	25	14		89	12	6
9	Noell, York	Pennsylvania	Sept. 20, 1870	16	5	23	29	8	12	17	9	15	18	19	10		127	6	26
19	Nostrand, Warner Hatch	New York	Sept. 23, 1870	17	10	19	19	24	28	21	12	14	13	27	18		131	6	26
10	Parker, John Frederick	Ohio	Sept. 29, 1870	17	5	9	9	9	23	9	22	7	6	7	12		149	6	26
29	Pearce, David	New Jersey	Sept. 28, 1869	15	4	24	21	30	5	19	17	27	8	30	28		141	10	14

[illegible]

CADETMIDSHIPMEN

First Class—32 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.										Navy service.											
				Years.	Months.	Seamanship.	Practical exercises in Seamanship.	Naval Tactics.	Ship-building.	Gunners.	Infantry Tactics.	Fencing.	Astronomy.	Electricity.	Applied Mathematics.	Mechanics.	French.	Drawing.	No. of Demerits.	Months.	Days.						
2	Amesden, Charles Heath.....	Ohio.....	Sept. 20, 1871.....	17	11	3	4	4	1	6	5	4	13	5	7	4	10	190	6	26	190	6	26				
20	Beatty, Frank Edmund.....	Minnesota.....	Sept. 21, 1871.....	17	9	34	19	32	37	29	36	29	10	90	18	31	72	144	6	26	144	6	26				
20	Bostick, Edward Dorsey	South Carolina.....	Sept. 24, 1870.....	17	1	5	14	15	34	19	37	10	27	33	18	16	132	10	4	132	10	4	4				
22	Caperton, William Banks.....	Tennessee.....	June 5, 1871.....	15	11	35	37	49	31	33	7	31	25	20	22	16	19	6	26	19	6	26	19	6			
14	Carter, Fydelio Sharps.....	Illinois.....	Sept. 29, 1870.....	17	4	8	7	29	3	10	24	4	27	21	19	7	14	111	10	4	111	10	4	4			
13	Coffin, Frederick Wesley.....	Massachusetts.....	June 15, 1870.....	17	9	19	21	32	7	16	11	6	18	15	5	34	140	6	26	140	6	26	140	6			
31	Collins, Frank Sheldon.....	At large.....	Sept. 25, 1871.....	17	2	36	36	31	13	16	21	10	28	30	33	26	27	186	6	26	186	6	26	186	6		
10	Corbin, Clarence Arthur.....	Michigan.....	Sept. 26, 1870.....	17	2	9	9	20	17	25	3	24	17	0	9	12	94	186	10	4	94	186	10	4	4		
9	Cutler, William Gifford.....	At large.....	Sept. 20, 1871.....	16	11	22	14	27	19	19	14	20	7	13	11	6	22	89	6	26	89	6	26	89	6		
23	Daniels, David.....	Massachusetts.....	June 5, 1871.....	15	4	23	31	24	18	30	26	14	35	11	2	27	19	20	27	6	26	19	20	27	6		
22	Doyle, Robert Morris.....	Tennessee.....	Sept. 21, 1870.....	16	4	20	31	28	30	24	22	33	22	18	16	34	20	100	10	4	20	100	10	4	4		
6	Fletcher, Frank Friday.....	Iowa.....	Sept. 22, 1870.....	14	10	11	14	6	26	15	30	9	2	6	0	2	19	4	99	10	4	99	10	4	4		
12	Helm, James Meredith.....	Tennessee.....	Sept. 20, 1871.....	15	9	1	14	28	21	17	17	10	30	10	30	10	26	130	6	26	130	6	26	130	6		
15	Hodges, Harry Marsh.....	Illinois.....	Sept. 20, 1870.....	15	3	12	11	16	18	18	35	30	3	15	12	22	12	87	6	26	87	6	26	87	6		
1	Hodgson, Albon Charles.....	Georgia.....	June 5, 1871.....	17	10	4	2	1	1	1	93	1	2	1	1	1	36	137	6	26	137	6	26	137	6		
7	Hosley, Harry Hibbard.....	New Hampshire.....	Sept. 22, 1871.....	15	10	14	21	22	23	2	25	24	3	12	8	2	96	163	6	26	96	163	6	26	96	163	6
21	Howe, Alfred Leighton.....	Pennsylvania.....	Sept. 28, 1870.....	16	5	14	32	27	11	13	32	22	24	24	24	24	30	14	1	120	10	4	120	10	4	4	
24	Hughes, Walter Scott.....	Iowa.....	Sept. 24, 1870.....	17	11	7	21	6	14	15	22	4	5	5	14	14	8	0	6	8	0	6	8	0	6	8	
24	Hunt, Henry Jackson.....	At large.....	June 22, 1870.....	15	2	24	4	25	33	32	22	90	17	27	37	3	195	10	4	195	10	4	195	10	4	4	
32	Hunt, Ridgely.....	Louisiana.....	Sept. 20, 1870.....	16	7	26	9	35	25	34	36	34	36	34	31	30	94	33	11	146	10	4	146	10	4	4	
5	Latrd, Charles.....	Ohio.....	Sept. 23, 1870.....	16	7	2	21	4	8	31	13	8	31	13	8	10	6	9	124	0	26	124	0	26	124	0	

17	Stuart, Alexander, Jr	Dist. of Columbia	June 30, 1870	14	7	11	6	13	11	5	12	15	35	21	25	34	18	123	10	4	
16	Shearman, John Adams	New York	June 7, 1871	16	10	11	11	8	36	27	27	21	8	21	15	13	21	20	185	0	26
25	Smith, James Thomas	North Carolina ..	June 5, 1871	16	3	32	32	34	31	17	31	35	20	23	28	31	8	28	25	6	26
30	Stoney, George	Alabama	Sept. 20, 1870	17	11	26	19	33	34	32	25	29	27	23	21	36	22	149	6	26	
18	Townley, Richard Henry ..	Nebraska	June 30, 1870	17	4	21	7	7	9	9	4	4	23	16	22	23	29	34	183	6	26
7	Usher, Nathaniel Bailey ..	Indiana	Sept. 21, 1871	16	5	17	21	5	8	3	11	12	14	10	17	5	17	14	185	6	26
27	Vinton, Frederick Betts ..	New York	Sept. 20, 1871	16	9	28	29	26	24	30	29	26	18	28	32	17	14	33	133	6	26
3	Winslow, Cameron McKee ..	At large	Sept. 27, 1870	16	1	6	1	4	7	12	6	1	5	4	4	2	12	2	133	6	26
11	Wood, Moses Lindley	Missouri	Sept. 21, 1871	17	1	34	21	8	33	8	28	3	16	14	9	4	22	7	73	6	26
19	Worcester, George Henry ..	New York	Sept. 26, 1871	14	3	29	28	8	10	2	18	27	9	6	18	30	29	29	193	6	26
†	Jardine, Augustus Edward ..	At large	Sept. 21, 1870	15	8	16	35	20	20	26	20	16	27	34	24	35	16	29	13	10	4

† Turned back to second class.

CADET-MIDSHIPMEN.

Second Class—48 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.										Sea-service.		
				Years.	Months.	Seamanship.	Ordnance Instru- ctions.	Mechanical Drawing.	Mathematics.	Chemistry.	History.	Rhetoric.	French.	Drawing.	Fencing.	Number of Demerits.	Years.	Months.
7	Allen, William Herschell.....	Illinois.....	Sept. 26, 1872	15	10	10	15	52	3	2	22	6	17	38	92	139	3	18
11	Boush, Clifford Joseph.....	Virginia.....	June 5, 1872	17	9	5	4	16	16	13	23	22	12	8	12	83	3	18
1	Brown, Stimson Joseph.....	New York.....	Sept. 16, 1872	17	11	4	8	44	2	5	3	5	1	5	3	231	3	18
22	Braunersreuther, William.....	Illinois.....	Sept. 23, 1871	17	7	15	10	40	50	10	44	36	33	37	6	91	3	18
40	Chambers, Washington Irving.....	New York.....	June 5, 1871	15	2	34	37	8	37	51	49	51	17	11	1	182	8	27
31	Coffman, De Witt.....	Virginia.....	June 6, 1872	17	6	22	16	44	39	40	34	47	25	30	8	10	3	18
18	Culver, Abraham Ellis.....	New York.....	June 5, 1872	16	2	34	57	40	19	20	12	11	10	18	36	134	6	9
29	Case, Daniel Rogers.....	At large.....	June 5, 1872	15	0	22	41	29	27	27	27	25	45	44	19	279	6	9
43	Fisher, Elstner Nelson.....	Pennsylvania.....	Sept. 21, 1872	17	11	53	53	20	44	12	40	46	44	29	15	246	3	18
9	Fonk, George Clayton.....	Pennsylvania.....	June 14, 1872	15	7	3	12	16	14	11	5	7	16	9	25	151	6	9
2	Geating, Henry Chalfant.....	Pennsylvania.....	June 12, 1872	17	3	14	11	40	1	4	2	9	6	19	98	238	6	9
20	Gillmore, James Clarkson.....	Pennsylvania.....	Sept. 20, 1871	17	2	20	13	1	26	21	37	24	28	2	38	115	6	6
24	Gove, Charles Augustus.....	New Hampshire.....	June 5, 1871	16	11	18	26	6	24	23	30	34	40	32	36	215	6	6
44	Grabo, Hermann Francis.....	New Jersey.....	Sept. 22, 1871	16	0	48	55	24	45	49	55	41	31	14	38	103	3	18
41	Griffin, Thomas Dillard.....	Virginia.....	Sept. 20, 1872	17	9	50	44	52	37	47	36	31	11	48	40	203	3	18
39	Hall, Alfred Lovell.....	Ohio.....	Sept. 16, 1872	17	11	17	20	18	41	25	46	49	42	45	22	40	8	27
30	Hannum, William Gangwere.....	Pennsylvania.....	Sept. 23, 1872	16	1	27	38	21	29	41	20	27	31	42	19	223	6	9
25	Henderson, Richard.....	North Carolina.....	Sept. 28, 1872	17	1	31	48	32	20	17	30	39	33	15	33	215	3	8
32	Hogg, William Stetson.....	At large.....	Sept. 24, 1872	15	10	28	44	10	25	38	42	41	41	34	7	77	3	18
5	Jardine, Augustus Edward.....	At large.....	Sept. 21, 1870	15	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	4
12	Jackson, Stephen.....	New York.....	Sept. 21, 1871	14	2	11	39	5	13	19	6	2	5	11	1	156	6	6
26	Jackson, Henry Albert.....	At large.....	June 5, 1872	17	0	31	42	2	20	48	52	30	39	1	10	223	3	18

		June 6, 1872	16	7	13	14	19	10	1	4	13	8	7	19	230	3	61
46	Kale, Edward Mero	Wisconsin	June 7, 1871	16	4	59	50	94	46	53	51	59	(a)	41	54	164	3
45	Kale, Koroku	Empire of Japan	Oct. 7, 1872	17	1	45	47	49	43	54	45	54	(a)	50	52	87	3
35	Kanikoma, Goro	Virginia	June 13, 1872	16	0	44	33	49	39	37	59	36	43	43	182	6	9
31	Kallory, Stevenson Blount	Vermont	June 13, 1872	15	6	15	7	40	30	39	19	53	36	16	45	240	3
9	Mayo, Henry Thomas	At large	June 6, 1872	16	10	9	2	47	9	7	1	1	39	36	49	113	3
34	McLeeth, Henry	Kentucky	June 6, 1872	15	9	34	32	36	29	31	28	35	48	21	15	247	3
48	Malligan Richard Thomas	New Jersey	June 5, 1871	15	0	46	24	27	35	30	35	47	49	10	34	169	8
13	Newton, John Thomas	At large	Oct. 14, 1872	17	0	29	19	24	19	16	15	16	2	32	19	173	3
33	Piepmeyer, Louis William	At large	Sept. 22, 1871	17	0	43	23	39	47	46	11	4	14	53	23	169	6
19	Pond, Charles Fremont	Connecticut	June 13, 1872	15	7	34	28	14	17	32	9	12	23	13	48	243	3
6	Potts, Templin Morris	At large	June 6, 1872	16	7	8	1	32	5	15	10	14	7	45	49	249	3
26	Proudfit, John McLean	At large	Sept. 24, 1872	17	5	30	25	14	28	43	41	40	21	27	29	230	3
23	Ray Robert Clary	At large	Oct. 1, 1872	17	11	39	21	21	18	35	16	37	19	45	45	96	3
15	Reynolds, Lovell Knowles	Alabama	June 5, 1871	14	4	2	9	26	30	22	18	21	29	27	14	230	6
10	Rogers, Charles Custis	Tennessee	June 7, 1872	16	0	38	18	37	4	18	8	3	3	16	11	85	3
17	Rollins, Anthony Wayne	Kentucky	June 10, 1872	17	3	19	30	43	8	44	26	26	26	22	53	179	6
27	Rose, William Darcy	At large	June 5, 1872	15	11	28	31	35	33	26	24	33	37	26	(a)	90	3
4	Scars, James Hamilton	New York	Sept. 30, 1871	16	8	6	6	31	5	9	2	10	12	3	9	238	6
28	Sherman, Francis Howland	Missouri	Sept. 30, 1871	16	5	33	29	4	34	29	25	29	37	27	32	98	8
36	Tappan, Benjamin	Arkansas	Sept. 31, 1871	15	5	42	22	29	42	34	33	15	21	50	15	176	6
16	Varnum, William Luby	Pennsylvania	June 5, 1871	16	6	1	5	21	14	28	14	45	45	35	4	64	8
3	Walling, Burns Tracy	Ohio	June 5, 1872	17	4	12	3	32	5	3	7	8	8	38	47	191	3
14	Winch, Thomas Garfield	Ohio	Sept. 30, 1872	17	10	20	17	3	11	6	13	17	48	6	4	210	3
38	Wise, Edward Everett	At large	June 5, 1871	16	6	47	36	13	35	33	48	37	23	3	51	201	6
1	Wood, Thomas Newton	At large	June 6, 1871	16	7	41	35	11	54	45	31	50	50	30	41	238	6
†	Horton, Cyrus William	New York	June 12, 1872	16	11	39	43	19	51	24	45	44	35	53	31	322	3
†	Macomb, Augustus Canfield	Kentucky	Sept. 24, 1872	17	11	28	26	8	39	8	32	18	15	38	47	344	3
†	Poland, Edward Rowell	Vermont	Sept. 31, 1871	16	6	(a)	46	56	(a)	(a)	53	(a)	19	(a)	(a)	114	6

† Turned back from first class.

‡ Turned back to third class.

§ Deficient.

CADET-MIDSHIPMEN]

Third Class—64 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.					Sea-service.	
				Years.	Months.	Mathematics.	Grammar.	History.	French.	No. of Demerits.	Months.	Days.
36	Benson, William Shepherd.....	Georgia.....	Sept. 21, 1873	16	11	39	57	40	38	74	3	8
10	Boatwick, Frank Matteson.....	Wisconsin.....	Sept. 26, 1873	16	5	16	11	16	12	149	3	8
37	Brice, Jonathan Kearley.....	Ohio.....	June 13, 1873	17	8	35	26	51	54	246	3	8
6	Bronaugh, William Venable.....	Kentucky.....	June 5, 1873	17	9	4	12	8	32	183	3	8
38	Brunby, Thomas Mason.....	Georgia.....	Sept. 26, 1873	17	10	33	25	21	46	58	3	8
42	Buckley, Frank Seidon.....	Michigan.....	Sept. 26, 1873	15	11	44	32	54	66	20	3	8
40	Burdick, William Leslie.....	Ohio.....	Sept. 26, 1873	16	9	52	44	42	52	109	3	8
40	Cass, Frank Blair.....	Michigan.....	June 7, 1873	15	7	26	57	68	76	195	3	8
60	Castle, Mark Cheney.....	Minnesota.....	Sept. 29, 1873	16	9	50	51	72	74	284	3	8
55	Cook, Simon.....	Missouri.....	June 6, 1873	16	11	39	67	78	54	10	3	8
34	Constant, Walter Malbone.....	Indiana.....	June 13, 1873	16	3	36	34	29	44	60	3	8
14	David, William Glenn.....	New York.....	Sept. 25, 1873	17	2	18	9	19	38	194	3	8
52	Denfold, George William.....	Massachusetts.....	Sept. 26, 1873	17	1	46	55	55	57	110	3	8
18	Dodd, Arthur Wright.....	Indiana.....	June 6, 1873	16	10	16	18	57	28	63	3	8
15	Dodge, Omenzo George.....	Kansas.....	June 13, 1873	17	0	12	31	22	48	229	3	8
33	Dombaugh, Harry Mason.....	Ohio.....	June 6, 1872	16	4	19	52	59	62	172	3	8
48	Dunn, Herbert Omar.....	Rhode Island.....	June 6, 1873	16	0	54	36	33	61	55	3	8
61	Dykeman, John Henry.....	Iowa.....	June 5, 1873	17	5	61	75	66	70	156	3	8
53	Endress, William Pelee.....	Connecticut.....	Sept. 21, 1873	17	1	46	55	55	57	110	3	8

CADET-MIDSHIPMEN.
Third Class—64 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.						Sea-service.	
				Years.	Months.	Mathematics.	Grammar.	History.	French.	No. of demerits.	Months.	Days.	
58	Wilson, John Cochran, Jr.	New York	Sept. 25, 1873	16	3	54	54	71	27	291	3	8	
3	Winterhalter, Albert Gustavus	Michigan	Sept. 22, 1873	16	11	6	4	10	2	41	3	8	
2	Witzel, Horace Mark	Wisconsin	June 3, 1873	15	4	1	3	5	18	66	3	8	
25	Wood, Albert Norton	Indiana	Sept. 24, 1873	16	6	26	21	17	49	246	3	8	
21	Woodworth, Selim Edward	At large	Sept. 30, 1872	15	5	26	28	24	1	280	3	8	
17	Wright, Edward Everett	Massachusetts	Sept. 20, 1873	17	0	34	7	5	16	27	3	8	
†	Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3	65	40	37	67	66	3	8	
†	Blodgett, Spencer Langdon	Pennsylvania	Sept. 26, 1873	15	4	75	80	82	88	94	3	8	
†	Caulfield, William Chase	At large	Sept. 23, 1873	16	1	70	42	98	50	69	3	8	
†	Carrington, Austin Downs	Virginia	Sept. 23, 1873	17	5	69	50	56	36	187	3	8	
†	Dent, Balno Caruthers	At large	June 5, 1873	16	7	(a)	(a)	(a)	(a)	308	3	8	
†	Fauntleroy, Robert Powell	At large	Sept. 23, 1873	16	5	77	47	69	42	194	3	8	
†	Hall, William Edward Wyatt	Maryland	June 14, 1873	17	3	72	78	83	64	276	3	8	
†	Hess, George Henry	Michigan	Sept. 23, 1873	17	7	71	74	44	71	186	3	8	
†	Mason, John Green	Ohio	June 5, 1873	17	6	73	83	85	91	189	3	8	
†	Purcell, John Lewis	New Jersey	Sept. 29, 1873	17	4	80	81	76	86	35	3	8	
†	Ryan, Thomas William	Pennsylvania	June 13, 1873	16	11	64	49	39	13	151	3	8	
†	Taylor, Bushrod Wilber	At large	Sept. 20, 1873	14	7	91	97	(a)	89	27	3	8	
†	Tracy, Arthur Barton	New York	June 5, 1873	16	10	68	43	30	6	44	3	8	
†	Todd, Wilson Lemuel	Pennsylvania	June 5, 1873	15	1	76	84	89	79	245	3	8	
†	Wright, Robert Kemp	Pennsylvania	June 10, 1873	14	8	74	65	61	53	217	3	8	

† Turned back from second class.

† Turned back to fourth class.

CADET-MIDSHIPMEN.

Fourth Class—103 members.

Name.	State.	Date of admission.	Age at date of admission.	
			Y'rs.	Mo's.
antaro	Empire of Japan	June 4, 1874	17	3
Charles Nelson	New York	Sept. 24, 1873	16	3
entice	Kentucky	Sept. 28, 1874	17	1
nry Edwin, jr.	Mississippi	Sept. 24, 1874	17	0
Louis Hull	Colorado	June 13, 1874	16	11
David L	Missouri	Sept. 24, 1874	15	5
eph	Pennsylvania	Oct. 12, 1874	14	10
Arthur	West Virginia	June 13, 1874	16	11
Oliver Hazard Perry	New York	Sept. 30, 1874	14	10
ton Benajah	Alabama	June 12, 1874	17	3
encer Fullerton Baird	At large	June 13, 1874	15	5
Spencer Langdon	Pennsylvania	Sept. 26, 1873	15	4
ward County	Missouri	June 12, 1874	17	4
n Platt	New York	Sept. 26, 1874	17	1
aries Kenwick	California	Oct. 21, 1874	16	0
ames Blake	Vermont	June 10, 1874	17	6
William Chase	At large	Sept. 23, 1873	16	1
n, Austin Downs	Virginia	Sept. 23, 1873	17	5
orge Ramsey	Ohio	June 9, 1874	17	3
liny Oliver	New York	June 13, 1874	14	9
iam Henry	Tennessee	Sept. 26, 1874	17	11
ambrose	Maryland	Sept. 28, 1874	17	6
ohn Eccleston	New Jersey	Sept. 24, 1874	15	10
William	Texas	Sept. 25, 1874	16	11
a, Le Roy Edmund	Dakota	Sept. 24, 1874	17	4
am, Andrew Charles	New York	June 9, 1874	16	4
ie Caruthers	At large	June 5, 1873	16	7
Thomas	Kentucky	Sept. 24, 1874	16	5
y, John Allen	Missouri	June 12, 1874	16	9
Percival Langdon	New York	June 10, 1874	16	2
ncis Hoyt	New Jersey	May 16, 1874	18	0
y, Robert Powell	At large	Sept. 23, 1873	16	5
John Hudson	Illinois	Sept. 24, 1874	17	10
Edward Daniel	Maryland	Oct. 2, 1874	15	11
Charles Warren	Indiana	June 5, 1874	17	10
ohn	Kentucky	Feb. 16, 1874	18	0
James Henry	California	Sept. 24, 1874	17	7
William Alfred	New York	Sept. 28, 1874	14	11
ed Gilliat	Illinois	Sept. 26, 1874	15	11
es	Illinois	Sept. 24, 1874	15	8
Arthur Benjamin	Illinois	Sept. 28, 1874	16	7
iam Edward Wyatt	Maryland	June 14, 1873	17	3
rge Henry	Michigan	Sept. 23, 1873	17	7
ton, James Henry	Iowa	June 9, 1874	17	7
John Hite Lee	At large	June 27, 1874	17	9
n	Alabama	June 12, 1874	14	6
ratio Hill	Illinois	Sept. 26, 1874	17	0
tichard Morris	Pennsylvania	Sept. 25, 1874	15	8
ry McLaren Pinkney	New York	Sept. 30, 1874	15	10
Charles William	Wisconsin	Sept. 24, 1874	15	6
Harry	Pennsylvania	Sept. 28, 1874	14	5
Larry Shepard	Connecticut	June 26, 1874	18	0

24 REGISTER OF THE UNITED STATES NAVAL ACADEMY.

CADET-MIDSHIPMEN—Continued.

Fourth Class—103 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Y'rs.	Mo's.
Knapp, John Joseph	Missouri	June 9, 1874	16	8
Lopez, Robert Files	Tennessee	Sept. 29, 1874	17	6
Lloyd, Edward, jr	Maryland	June 17, 1874	16	11
Mason, John Greene	Ohio	June 5, 1873	17	6
Maury, Alfred Ingraham	Mississippi	Sept. 28, 1874	15	11
Maxwell, William John	At large	June 9, 1874	15	2
Mayer, Chester Alfred	New York	June 16, 1874	17	5
McDonnell, John Edmund	Nevada	Sept. 30, 1874	16	4
Meares, Frederick Parkhouse	North Carolina	Sept. 25, 1874	16	3
Melton, Lawson	South Carolina	Sept. 25, 1874	16	3
Menefee, Daniel Preston	California	Sept. 25, 1874	16	6
Morey, Alfred George	Louisiana	Sept. 25, 1874	16	11
Nambo, Heldemaro	Empire of Japan	June 5, 1874	16	1
Paxton, Alfred Noble	Ohio	Sept. 24, 1874	17	4
Perry, George Ernest	Illinois	June 10, 1874	14	7
Perry, John Adams	Nebraska	Sept. 29, 1874	15	1
Picking, William Webster	Pennsylvania	Sept. 24, 1874	16	11
Poundstone, Homer Clarke	West Virginia	Sept. 24, 1874	14	0
Preble, George Henry Rittenhouse	At large	Sept. 28, 1874	15	2
Purcell, John Lewis	New Jersey	Sept. 29, 1873	17	4
Quimby, John Garóner	At large	June 12, 1874	14	10
Read, Maurice Lance	South Carolina	Sept. 28, 1874	15	10
Redfern, Joseph Louis	At large	July 13, 1874	17	11
Richardson, Samuel	Mississippi	June 17, 1874	16	1
Rodgers, Thomas Sildell	District of Columbia	Sept. 24, 1874	16	1
Rodgers, William Ledyard	California	June 11, 1874	14	4
Rogers, Allen Grey	North Carolina	June 12, 1874	14	6
Rowan, Andrew Summers	West Virginia	Sept. 25, 1874	17	5
Ryan, Thomas William	Pennsylvania	June 13, 1873	16	11
Schwerin, Rennie Pierre	New York	Sept. 25, 1874	16	1
Shipley, John Harry	Missouri	Sept. 30, 1874	16	6
Skinner, Frank Colby	Massachusetts	Sept. 28, 1874	17	6
Smith, Roy Campbell	Virginia	Oct. 3, 1874	16	2
Sparhawk, George	Massachusetts	Sept. 24, 1874	17	6
Sprague, Frank Julian	Massachusetts	Sept. 29, 1874	17	2
Stafford, George Henry	Iowa	June 10, 1874	17	11
Sturdevant, Harry Leland	Maine	June 13, 1874	17	8
Swift, Franklin	Massachusetts	June 9, 1874	16	1
Taylor, Bushrod Wilber	At large	Sept. 20, 1873	14	7
Tillman, Edwin Hord	Tennessee	Sept. 28, 1874	15	11
Todd, William Lemuel	Pennsylvania	June 5, 1873	15	1
Tracy, Arthur Barton	New York	June 5, 1873	16	10
Van Horn, George	New York	June 9, 1874	17	6
Wallace, Carshena	Washington	May 15, 1874	18	0
Webb, Lovell Hastings	Kansas	Sept. 28, 1874	17	7
Webster, Edwin Belden	Connecticut	Sept. 28, 1874	16	6
Welsh, George Silvia	Pennsylvania	Sept. 24, 1874	17	7
White, William Porter	At large	June 30, 1874	15	5
Wilson, Llewellyn Victor	District of Columbia	Sept. 25, 1874	17	0
Wright, Robert Kemp	Pennsylvania	June 12, 1873	14	8
Young, Feramorz Little	Utah	Sept. 24, 1874	16	0

CADET-ENGINEERS.

Graduating Class—10 members.

Name.	State.	Date of admission.	Age at date of admission.		Order of merit.								Sea-service.	
			Years.	Months.	Electricity.	Chemistry.	Statics.	French.	Applied mathematics and mechanics.	Heat.	Steam.	Conduct.	Months.	Days.
Alfred Bruce	Ohio.	Oct. 1, 1872	21	9	7	3	2	5	4	9	11	1	2	26
William Colgate	N. Y.	Oct. 1, 1872	21	7	6	1	3	3	2	2	10	5	2	26
John Richard	Pa...	Oct. 1, 1871	18	2	8	8	5	7	7	5	8	3	6	2
Frank Jacob	Md...	Oct. 1, 1872	19	11	2	4	4	1	3	6	6	8	2	26
Asa	N. Y.	Oct. 1, 1872	19	2	1	1	1	4	1	1	1	1	2	26
Wy	Pa...	Oct. 1, 1871	18	7	4	11	6	11	5	8	2	14	6	2
George Brinkerhoff.	N. Y.	Oct. 1, 1871	20	3	5	6	7	6	8	10	5	11	6	2
Benjamin Howard ..	Mass.	Oct. 1, 1871	21	7	10	5	12	9	12	7	3	10	6	2
Albert Bowen	Pa...	Oct. 1, 1872	21	6	3	9	8	13	6	4	7	3	2	26
Sam Varboy	Pa...	Oct. 1, 1871	21	1	11	12	9	8	9	3	4	13	6	2
William Brenton	D. C.	Oct. 1, 1871	19	11	14	13	14	2	14	12	12	9	6	2
Frank Harold	Ohio	Oct. 1, 1872	20	2	13	10	11	14	13	11	13	7	2	26
Charles	Pa...	Oct. 1, 1871	18	7	9	7	13	12	10	14	9	5	6	2
John Edgar Townsend	Pa...	Oct. 1, 1872	17	3	12	14	10	10	11	13	14	12	2	26

§ Turned back to first class.

CADET-ENGINEERS.

First Class—16 members.

Name.	State.	Date of admission.	Age at date of admission.		Order of merit.				No. of demerits.	Sea-service.	
			Years.	Months.	Mathematics.	Steam.	French.			Months.	Days.
Henry Thomas	Ohio ..	Oct. 1, 1873	17	2	12	14	9	154	3	9	
Frank Hughes	Pa	Oct. 1, 1873	22	3	1	1	19	15	3	9	
William Brenton	D. C. ..	Oct. 1, 1871	19	11	.....	.....	.....	.....	6	2	
Theodore Frederick ..	N. J. ..	Oct. 1, 1873	18	9	10	8	5	0	3	9	
William Ledyard	Conn ..	Oct. 1, 1873	18	1	7	2	7	20	3	9	
William	N. Y. ..	Oct. 1, 1873	18	7	4	3	9	28	3	9	
Alberto	Pa	Oct. 1, 1873	20	5	9	7	1	160	3	9	
Frank Harold	Ohio ..	Oct. 1, 1872	20	2	.....	.....	.....	.....	2	26	
Edward Russell	Miss ..	Oct. 1, 1873	19	9	5	12	6	43	3	9	
William Richard	Md	Oct. 1, 1872	19	9	2	5	4	125	6	5	
Charles	Pa	Oct. 1, 1871	18	7	.....	.....	.....	.....	6	2	
William Nelson, Jr.	Ga	Oct. 1, 1872	19	8	6	4	8	142	6	5	
Edmund Underwood ..	Md	Oct. 1, 1872	21	3	13	10	14	20	3	9	
George Sidney	Pa	Oct. 1, 1873	20	6	3	9	3	31	3	8	
John Edgar Townsend ..	Pa	Oct. 1, 1872	17	3	.....	.....	.....	.....	2	26	
Walter Fitzhugh	Md	Oct. 1, 1873	18	6	8	11	2	42	3	9	
William Batey	N. Y. ..	Oct. 1, 1873	19	2	14	13	15	86	3	9	
Robert Ingersoll	Pa	Oct. 1, 1872	20	2	15	17	13	113	3	9	
Henry Hicks	N. Y. ..	Oct. 1, 1873	18	0	17	5	16	79	3	9	

§ Turned back and forming the second class.

§ Turned back from the graduating class.

26 REGISTER OF THE UNITED STATES NAVAL ACADEMY.

CADET-ENGINEERS.

Fourth Class—27 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
Bartlett, Frank W	Michigan	Oct. 1, 1874	18	1	10
Bennett, Frank M.	Michigan	Oct. 1, 1874	17	5	36
Bieg, Frederick Charles	Missouri	Oct. 1, 1874	18	6	11
Bull, Gould Hoyt	Pennsylvania	Oct. 1, 1874	18	4	17
Burd, George Eli	Massachusetts	Oct. 1, 1874	17	5	14
Claude, Gordon Handy	Maryland	Oct. 1, 1874	20	0	13
Cooley, Mortimer Elwyn	New York	Oct. 1, 1874	19	6	7
Crygier, John Ulysses	New York	Oct. 1, 1874	16	6	16
Dungan, Horace Greeley	Iowa	Oct. 1, 1874	20	6	19
Elseffer, Harry Smith	Iowa	Oct. 1, 1874	19	3	22
Gage, Howard	Michigan	Oct. 1, 1874	18	1	8
Gow, John London	Indiana	Oct. 1, 1874	18	4	9
Griffin, Robert Stanislaus	Virginia	Oct. 1, 1874	17	0	12
Harrison, Henry Fillmore	Maryland	Oct. 1, 1874	18	9	20
Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10	5
Hollis, Ira Nelson	Kentucky	Oct. 1, 1874	18	6	1
Ivers, Henry King	Missouri	Oct. 1, 1874	18	6	24
McElroy, George Wightman	Michigan	Oct. 1, 1874	16	6	21
Norton, Harold Percival	New York	Oct. 1, 1874	18	10	23
O'Connor, Henry	District of Columbia	Oct. 1, 1874	19	3	27
Pickrell, Joseph McCall	Virginia	Oct. 1, 1874	17	2	4
Salisbury, George Robert	Missouri	Oct. 1, 1874	19	7	22
Schell, Franklin Jacob	Pennsylvania	Oct. 1, 1874	17	1	3
Scribner, Edward Herschell	Massachusetts	Oct. 1, 1874	19	11	15
Spangler, Harry Wilson	Pennsylvania	Oct. 1, 1874	16	9	4
Wight, Charles Leslie	Massachusetts	Oct. 1, 1874	21	1	2
Wilmer, Joseph Ringgold	Maryland	Oct. 1, 1874	20	10	13

SUMMARY.

Academic Year, 1874-75.

CADET-MIDSHIPMEN.

First Class	33 members.
Second Class	48 members.
Third Class	64 members.
Fourth Class	103 members.

CADET-ENGINEERS.

First Class	16 members.
Second Class	3 members.
Fourth Class	27 members.

Total..... 223

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States, approved July 27, 1868.

RESIGNATIONS AND DISMISSALS.

RESIGNATIONS.

Cadet-Midshipman E. H. Gaither	Oct.	30, 1873.
Cadet-Engineer B. F. Kelley	Oct.	30, 1873.
Cadet-Engineer J. M. White	Oct.	30, 1873.
Cadet-Midshipman E. D. Leach	Nov.	5, 1873.
Cadet-Midshipman J. H. Conyers	Nov.	11, 1873.
Cadet-Midshipman S. M. Peacock	Nov.	11, 1873.
Cadet-Midshipman C. C. J. Norris	Nov.	26, 1873.
Cadet-Midshipman W. F. Ustick	Feb.	16, 1874.
Cadet-Midshipman C. R. Crenshaw	Mar.	16, 1874.
Cadet-Midshipman A. C. McClenan	Mar.	16, 1874.
Cadet-Midshipman J. F. LeBrou	Mar.	17, 1874.
Cadet-Midshipman F. C. Morris	April	6, 1874.
Cadet-Midshipman R. Horton	April	6, 1874.
Cadet-Midshipman A. R. Mitchell	May	1, 1874.
Cadet-Midshipman W. Crosby	May	1, 1874.
Cadet-Midshipman Thomas Green	May	1, 1874.
Cadet-Engineer T. F. Carter	May	4, 1874.
Cadet-Midshipman J. B. Gilder	May	4, 1874.
Cadet-Midshipman C. E. Lee	May	6, 1874.
Cadet-Midshipman H. R. Griffith	May	11, 1874.
Cadet-Engineer L. Morgan	May	14, 1874.
Cadet-Midshipman T. H. Taylor	May	14, 1874.
Cadet-Engineer C. H. Frizell	May	16, 1874.
Cadet-Midshipman W. G. Clark	June	11, 1874.
Cadet-Midshipman G. D. Donnelly	June	11, 1874.
Cadet-Midshipman E. C. Goss	June	11, 1874.
Cadet-Midshipman J. W. Albertson	June	11, 1874.
Cadet-Midshipman J. Ancona	June	11, 1874.
Cadet-Midshipman M. O. Bunn	June	11, 1874.
Cadet-Midshipman T. Dickinson	June	11, 1874.
Cadet-Midshipman R. M. Donovan	June	11, 1874.
Cadet-Midshipman F. S. Goidling	June	11, 1874.
Cadet-Midshipman W. C. Riorden	June	11, 1874.
Cadet-Midshipman W. C. Hagar	June	11, 1874.
Cadet-Midshipman H. S. Holmes	June	11, 1874.
Cadet-Midshipman H. B. Lindley	June	11, 1874.
Cadet-Midshipman J. L. Purcell	June	11, 1874.
Cadet-Midshipman E. P. Sanders	June	11, 1874.
Cadet-Midshipman W. K. Stevens	June	11, 1874.
Cadet-Midshipman W. L. Todd	June	11, 1874.
Cadet-Midshipman W. Vinson	June	11, 1874.
Cadet-Engineer C. N. Johnson	June	11, 1874.
Cadet-Engineer L. Olmsted	June	11, 1874.
Cadet-Engineer G. H. Claude	June	11, 1874.
Cadet-Engineer Harvey Eastman	Oct.	5, 1874.
Cadet-Midshipman J. S. Manley	Oct.	9, 1874.

28 REGISTER OF THE UNITED STATES NAVAL ACADEMY.

Cadet-Midshipman H. C. White.....	Oct.	9, 1874.
Cadet-Midshipman A. W. Wills.....	Oct.	9, 1874.
Cadet-Midshipman H. G. Chase.....	Oct.	9, 1874.
Cadet-Midshipman H. W. Ford.....	Oct.	9, 1874.
Cadet-Midshipman N. J. L. T. Halpine.....	Oct.	9, 1874.
Cadet-Midshipman S. M. Peacock.....	Oct.	9, 1874.
Cadet-Midshipman J. D. Chase.....	Oct.	9, 1874.
Cadet-Midshipman T. G. Harkness.....	Oct.	9, 1874.
Cadet-Midshipman S. L. Heap.....	Oct.	9, 1874.
Cadet-Midshipman J. A. Lockwood.....	Oct.	9, 1874.
Cadet-Midshipman R. H. Lull.....	Oct.	9, 1874.
Cadet-Midshipman B. W. Parker.....	Oct.	9, 1874.
Cadet-Midshipman W. Sencerbox.....	Oct.	9, 1874.
Cadet-Midshipman M. A. Vinton.....	Oct.	9, 1874.
Cadet-Midshipman C. H. Walsh.....	Oct.	9, 1874.
Cadet-Engineer G. L. Drouillard.....	Oct.	9, 1874.

DISMISSALS.

Cadet-Midshipman A. C. Almy, dropped.....	Mar.	31, 1874.
Cadet-Midshipman F. S. Goalding, dropped.....	June	11, 1874.
Cadet-Midshipman H. B. Lindley, dropped.....	June	11, 1874.
Cadet-Midshipman W. C. Riorden, dropped.....	June	11, 1874.

SUMMER CRUISE, 1874.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION.

Capt. K. RANDOLPH BREESE, *Commanding*.
Lieut.-Commander P. H. COOPER, *Executive Officer*.
Lieut.-Commander P. F. HARRINGTON, *Navigator*.
Lieut.-Commander A. G. CALDWELL, *Instructor in Navigation*.
Lieut.-Commander JOHN SCHOUER, *Senior Watch-Officer*.
Lieut. W. H. BROWNSON, *Watch-Officer*.
Lieut. ASA WALKER, *Watch-Officer*.
Lieut. E. D. F. HEALD, *Watch-Officer*.
Surgeon J. H. TINKHAM.
Acting Assistant Surgeon W. J. CRONYN.
Paymaster J. A. SMITH.
Chaplain J. R. MATTHEWS.
First Lieutenant D. P. MANNIX, U. S. M. C.
Captain's clerk, C. M. MCLEOD.
Paymaster's clerk, F. C. ADAMS.
Boatswain, A. MILNE.
Gunner, R. SOMMERS.

CADET-MIDSHIPMEN.

First Class, (36.)

C. H. Amsden.	D. Daniels.	H. J. Hunt.	George Stoney.
P. E. Beatty.	R. M. Doyle.	R. Hunt.	R. H. Townley.
E. D. Bostick.	F. F. Fletcher.	A. E. Jardine.	N. R. Usher.
W. B. Caperton.	J. M. Helm.	C. Laird.	F. B. Vinton.
F. S. Carter.	H. M. Hodges.	J. S. Manley.	H. C. White.
F. W. Coffin.	A. C. Hodgson.	C. M. McCartney.	A. W. Wills.
F. S. Collina.	H. H. Hosley.	A. Sharp.	C. M. Winslow.
C. A. Corbin.	A. L. Howe.	J. A. Shearman.	M. L. Wood.
W. G. Cutler.	W. S. Hughes.	J. T. Smith.	G. H. Worcester.

Second Class, (14.)

D. R. Case.	H. C. Gearing.	S. B. Mallory.	A. W. Rollins.
W. J. Chambers.	A. L. Hall.	R. T. Mulligan.	F. H. Sherman.
A. E. Culver.	W. G. Hannum.	C. F. Pond.	W. L. Varnum.
G. C. Foulk.	R. Henderson.		

Third Class, (67.)

W. S. Benson.	J. H. Dykeman.	P. V. Lansdale.	O. J. Schoolcraft.
F. M. Bostwick.	W. F. Endress.	J. A. Lockwood.	W. Sencerbox.
J. K. Brice.	A. F. Fechteler.	R. H. Lull.	J. D. Sheeks.
W. V. Bronaugh.	L. C. Fletcher.	K. Machida.	B. W. Taylor.

F. M. Brumby.	A. B. Frenzel.	A. C. Macomb.	H. Taylor.
F. S. Buckley.	W. F. Fullam.	T. B. Maynadier.	F. W. Toppam.
W. L. Burdick.	A. Gleaves.	J. H. McNasser.	H. C. Wakenshaw.
F. B. Case.	A. W. Grant.	V. S. Nelson.	C. H. Walsh.
M. C. Castle.	W. Green.	J. H. Oliver.	P. J. Werlich.
J. D. Chase.	F. R. Heath.	J. M. Orchard.	C. S. Williams.
S. Cook.	B. W. Hodges.	G. F. Ormsby.	J. C. Wilson.
W. M. Constant.	F. Hodges.	W. B. Osterhout.	A. G. Winterhalter.
W. G. David.	C. W. Horton.	R. C. Paris.	H. M. Witzel.
G. W. Denfeld.	A. Jeffries.	B. W. Parker.	A. N. Wood.
A. W. Dodd.	H. C. Jones.	J. P. Parker.	E. E. Wright.
O. G. Dodge.	J. N. Jordan.	H. H. Rogers.	R. K. Wright.
H. O. Dunn.	W. R. Rush.		

Fourth Class, (11.)

C. N. Atwater.	A. D. Carrington.	W. E. W. Hall.	F. W. Ryan.
S. L. Blodgett.	B. C. Dent.	G. H. Hess.	A. B. Tracy.
W. C. Canfield.	R. P. Fauntleroy.	J. G. Mason.	

Sailed from Annapolis Roads, June 13; touched at Hampton Roads; crossed and re-crossed the Gulf Stream; cruised in Long Island Sound; touched at Newport, R. I., to witness torpedo practice, and arrived at the Naval Academy, September 22, 1874.

U. S. PRACTICE-STEAMER MAYFLOWER.

Lieut.-Commander O. A. BATCHELLER. *Commanding.*

Master, JOHN A. NORRIS.

Past Assistant Engineer, G. E. TOWER.

Past Assistant Engineer, C. H. MANNING.

Assistant Surgeon, J. M. AMBLER.

Assistant Paymaster, W. W. BARRY.

Mate, C. J. MURPHY.

Mate, T. W. BONSALE.

CADET-ENGINEERS.

First Class, (17.)

G. H. T. Babbitt.	G. L. Drouillard.	W. R. King.	A. de Ruiz.
F. H. Bailey.	W. B. Dunning.	C. Kleckner.	G. S. Willits.
T. F. Burgdorff.	F. H. Eldridge.	W. N. Little.	E. T. Warburton.
W. L. Cathcart.	E. R. Freeman.	E. N. Loomis.	W. F. Worthington.
W. Cowles.			

Second Class, (2.)

R. I. Reid.

H. H. Stivers.

Left her anchorage June 12 and proceeded to Washington, D. C.; touched at the navy-yard; steamed thence, touching at Norfolk, for the navy-yard, New York; thence to the navy-yards, Boston and Portsmouth, N. H., thence to Providence, R. I., Cold Spring, and West Point, N. Y., Wilmington, Del., Chester, Pa., navy-yard, Philadelphia, and thence for the Chesapeake Bay; touching at Hampton Roads, and arrived at the Naval Academy, September 22, 1874.

THE MERIT-ROLLS.

EXTRACT FROM CHAPTER VII. OF THE REGULATIONS OF THE UNITED STATES NAVAL ACADEMY.

At every annual examination, the Academic Board shall form a general merit-roll for each class, in the following manner: Of those members of each class who shall have received a satisfactory final average in any principal branch, the individual having the highest standing shall receive the maximum number assigned to such branch for that class and year in the table of maximum numbers, and the one having the lowest satisfactory average shall receive one-third of the maximum number; members of the class having intermediate standings shall receive numbers decreasing by equal differences from the maximum to one-third of the maximum, and members who have not received a satisfactory final average shall receive numbers decreasing by the same equal differences from one-third of the maximum, the class being arranged in order of merit, as fixed by their relative standing in the branch considered.

Of those who have not been found deficient in conduct, such as have no demerits shall receive the maximum number allowed for that class and year, and the others shall have that maximum diminished by one one-thousandth part of itself for every demerit recorded against them. All the numbers which shall be thus assigned to the several members for the several branches of study and for conduct shall then be added together, and the names of the members shall be arranged in each class according to the aggregates thus obtained, the highest number being placed first on the list, and the others in their order.

At the final academic examination, the Academic Board shall make up the "graduating merit-roll" for this class, by adding the numbers which each member of the class shall have received on the several "general merit-rolls" for the four years, and arranging the order of numbers according to the aggregates, placing the highest first. If any member has been put back from a higher class, the numbers from the merit-rolls of his former class shall be used to supply deficiencies.

RULES ADOPTED BY THE ACADEMIC BOARD TO BE OBSERVED IN PREPARING THE MERIT-ROLLS.

1. No final average below 2.50 (on a scale of 4) shall be considered *satisfactory* in assigning the multiples.

2. Whenever the same class-number shall be assigned to two or more persons in any branch, each shall receive as his multiple in that branch the *mean* of all the multiples which would have been assigned to such persons had they been numbered consecutively.

3. Whenever, for any reason, the class-standing of any person shall not be made out until after the multiples of the remainder of his class have been determined, the multiple assigned to such person in each branch shall be the *mean* of the multiples of the two members of his class between whom his relative standing in that branch places him.

4. Whenever the merit-rolls of a former class are used to supply deficiencies in the graduating merit-roll in the case of any Cadet who has been turned back, he shall receive the aggregate multiple which was allowed him in his former class, unless the maximum number allowed to that class in the table of maxima differs from the maximum number for the corresponding year of the class in which he was placed; in which case his aggregate multiple is to be increased or diminished in the same proportion as the maximum number of his former class has been increased or diminished.

Table of relative weights or maximum numbers to be assigned to each of the principal branches in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Principal branches.	First year—Fourth class.	Second year—Third class.	Third year—Second class.	Fourth year—First class.	Graduating maximum in the principal branches.
Seamanship.....	Seamanship.....		75	99	120	294
	Practical Exercises.....			30	51	81
	Naval Tactics.....			24		24
	Ship-building.....			24		24
	Gunnery.....			45	84	129
Ordnance and Gunnery....	Ordnance Instructions.....		48			48
	Infantry Tactics.....			30		30
	Fencing.....			9	9	18
Mathematics.....	Algebra and Geometry.....	120				120
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		162			162
Astronomy, Navigation, and Surveying.....	General astronomy.....			45		45
	Navigation and Surveying.....				153	153
	Chemistry.....		45			45
	Heat and Climatology.....				45	45
Physics and Chemistry....	Optics and Acoustics.....				30	30
	Magnetism and Electricity.....			45		45
	Applied Mathematics.....			60		60
	Applied Mathematics and Mechanics.....			60		60
	International law.....				30	30
English Studies, History, and Law.....	Rhetoric.....		42			42
	Physical Geography.....		33			33
	English.....	30				30
	History.....	42				42
Modern Languages.....	French.....	24	60	60		144
	Spanish.....				30	30
Drawing.....	Sketching and Topography.....		18	30		48
Steam-engineery.....	Marine-engines, Boilers, &c.....				84	84
Aggregate.....		216	483	561	636	1,296
Conduct.....		15	55	120	210	400

CADET-ENGINEERS.

Mathematics.....	Algebra and Geometry.....	120				
	Algebra, Trigonometry, Descriptive and Analytical Geometry.....			150		
	Heat.....				45	
	Electricity.....				45	
Physics and Chemistry....	Applied Mathematics.....				60	
	Applied Mathematics and Mechanics.....				60	
	Chemistry.....				99	
English Studies, History, and Law.....	English.....	30				
	History.....	42				
Modern Languages.....	French.....	24		51	45	
Steam-engineery.....	Steam-engineery.....				99	
	Steam.....					120
Aggregate.....		216		300	594	
Conduct.....		15		55	120	

MERIT-ROLLS FOR 1873-74.

NOTE.

Cadets whose names are marked thus (*) are the five most distinguished in their respective classes.

Those marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

Numbers in parentheses indicate final averages below 2.50.

a denotes absence from examination.

UNITED STATES NAVAL ACADEMY.
Merit-roll of the First Class, (30 members,) annual examination, May, 1874, and general merit-roll for four years.

Rank	Names in order of general merit.	State.	Date of admission.	Age at date of admission.		Scrimship.	Practical exercises in Scrimship.	Gunbery.	Fencing.	Steam-engineery.	Navigation.	Heut.	Light.	Law.	Spanish.	Conduct.	Aggregate fourth year.	Aggregate third year.	Aggregate second year.	Aggregate first year.	Graduating maximum.
				Years.	Months.	120	51	84	9	81	153	45	30	30	30	210	846	669	526	105	2146
1	George H. Peters	Pennsylvania	June 23, 1870	15	9	117	34	44	20	84	00	45	30	30	30	30	30	30	30	30	30
2	Bradley A. Fiske	Ohio	Sept. 22, 1870	16	3	93	17	19	04	72	31	42	09	29	31	37	93	190	47	798	93
3	Frank H. Holmes	California	June 26, 1870	17	9	120	00	36	04	70	98	43	25	23	79	13	45	193	53	762	19
4	Albert Wegmann	New York	Sept. 21, 1870	16	5	108	97	34	68	45	38	31	22	50	13	52	62	186	69	673	80
5	John W. Stewart	Indiana	Sept. 26, 1870	17	4	84	14	42	84	80	14	30	22	00	26	55	202	56	732	30	572
6	Henry F. Reich	Pennsylvania	Sept. 27, 1870	17	10	80	00	29	34	72	41	7	11	00	28	62	36	53	307	46	692
7	Lucian Flynn	Texas	Sept. 22, 1870	15	10	89	06	19	04	52	07	7	14	00	27	34	30	180	42	746	11
8	Hamilton Hutchins	New Hampshire	June 23, 1870	15	6	106	21	45	36	51	17	3	93	72	41	131	75	31	15	21	00
9	York Neell	Pennsylvania	Sept. 20, 1870	16	5	5	39	31	12	92	70	48	4	62	52	14	119	00	26	85	13
10	John F. Parker	Ohio	Sept. 28, 1870	17	5	95	17	40	12	84	55	4	45	68	55	01	63	38	09	25	86
11	Matthew G. Reynolds	Missouri	Sept. 31, 1870	15	10	114	42	51	00	41	50	9	00	60	63	136	00	37	69	19	00
12	John C. Colwell	At large	Sept. 31, 1870	15	1	73	10	38	08	60	83	3	63	64	69	59	25	34	62	18	00
13	William E. Whitfield	Arkansas	June 21, 1870	17	11	102	07	52	44	74	34	7	35	41	32	102	00	16	15	17	00
14	W. R. A. Rooney	Pennsylvania	Sept. 24, 1870	16	8	40	00	91	44	43	45	7	55	41	32	102	00	16	15	17	00
15	Edward J. Dorn	Missouri	Sept. 21, 1870	16	7	86	90	41	48	02	90	6	09	57	93	55	25	33	15	30	00
16	Edward C. Fuller	Ohio	Sept. 27, 1870	17	11	64	53	25	84	62	35	5	03	84	00	75	36	92	15	30	00
17	Winslow Alderice	Virginia	June 17, 1870	16	2	75	56	15	08	45	31	4	34	52	14	110	50	30	54	10	00
18	George E. Hutter	Alabama	June 21, 1870	17	3	95	17	38	08	47	31	3	41	41	106	25	30	77	18	00	00
19	Warner H. Nostrand	New York	Sept. 23, 1870	17	10	70	34	32	84	35	59	3	41	41	106	25	30	77	18	00	00
20	Bernard O. Scott	Alabama	June 20, 1870	17	5	80	00	48	96	35	79	7	55	32	83	97	75	30	77	18	00
21	Lyman Arms	Michigan	Sept. 24, 1870	16	10	102	07	33	32	56	97	8	29	45	31	61	63	11	54	10	00
22	Frank J. Milligan	Iowa	June 23, 1870	16	6	67	59	30	60	64	09	3	29	47	31	61	63	11	54	10	00
23	Charles W. Haskell	Tennessee	June 23, 1870	16	6	67	59	30	60	64	09	3	29	47	31	61	63	11	54	10	00
24	Edwin L. Reynolds	New Jersey	June 23, 1870	17	3	56	55	27	08	66	03	4	76	37	08	72	25	18	46	10	00
25	John Farnsworth	Illinois	Sept. 25, 1870	16	10	102	07	33	32	56	97	8	29	45	31	61	63	11	54	10	00
26	John M. Bowyer	Iowa	Sept. 25, 1870	17	3	56	55	27	08	66	03	4	76	37	08	72	25	18	46	10	00
27	John O. Nicolson	Alabama	June 23, 1870	16	10	102	07	33	32	56	97	8	29	45	31	61	63	11	54	10	00
28	George T. Emmons	At large	June 23, 1870	16	4	62	07	31	26	31	66	6	31	41	36	13	17	31	41	36	13
29	David Prescott	New Jersey	Sept. 25, 1870	17	11	42	76	31	90	37	66	6	31	41	36	13	17	31	41	36	13
30	Frederick W. Danner	Alabama	June 23, 1870	15	7	43	70	46	04	35	79	7	55	32	82	30	75	13	45	10	00

This is a recent decision of the Navy Department the modifications among the names are to be revised.

UNITED STATES NAVAL ACADEMY
Merit-roll of the Second Class, (37 members), annual examination, May, 1874.

Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Practical exercises in Seamanship.		Naval Tactics.	Ship-building.	Gunnery.	Infantry Tactics.	Fencing.	Astronomy.	Magnetism and Electricity.	Applied Mathematics and Mechanics.	Applied Mathematics.	French.	Drawing.	Conduct.	Aggregate.
			Years.	Months.	99	30	24	24	45	30	9	45	45	60	60	60	60	30	120	681
1 Albon C. Hodgson	Georgia	June 5, 1871	17	10	93.50	29.41	93.56	93.56	45.00	30.00	3.32	45.00	43.85	60.00	60.00	60.00	60.00	10.98	103.56	633.05
2 Charles H. Alden	Ohio	Sept. 20, 1870	17	11	95.33	37.94	16.89	21.33	40.83	27.78	9.00	34.41	45.00	55.43	51.72	56.67	56.67	25.00	103.60	614.93
3 Cameron M. Winslow	At large	Sept. 24, 1870	16	11	89.33	30.00	92.67	91.33	35.83	27.82	9.00	41.47	40.34	56.57	55.62	47.22	47.22	29.44	104.04	614.78
4 Walter F. Hughes	Iowa	Sept. 24, 1870	17	11	88.00	16.47	21.75	24.17	34.17	27.82	5.00	43.35	40.34	53.14	42.07	48.29	48.29	36.11	130.00	534.19
5 Charles F. Fletcher	Ohio	Sept. 28, 1870	16	7	97.17	16.47	24.00	22.67	43.50	26.11	7.67	44.12	36.95	58.66	57.24	33.33	33.33	27.50	103.92	572.69
6 Nathaniel R. Usher	Indiana	Sept. 28, 1870	16	5	78.83	21.18	21.28	19.89	33.33	13.89	7.67	44.12	36.95	58.66	57.24	33.33	33.33	27.50	103.92	572.69
7 Charles F. Fletcher	Indiana	Sept. 28, 1870	16	5	69.67	16.47	22.92	20.89	43.33	13.89	7.67	44.12	36.95	58.66	57.24	33.33	33.33	27.50	97.80	531.05
8 Harry H. Hooley	New Hampshire	Sept. 29, 1871	15	10	74.25	16.47	13.44	14.67	56.67	23.44	7.17	33.53	34.63	41.71	54.48	42.92	42.92	16.11	100.44	525.55
9 William G. Cutler	At large	Sept. 30, 1871	16	11	60.50	21.18	19.44	16.00	30.00	23.78	8.00	30.71	31.15	57.71	46.91	54.44	54.44	18.06	100.32	525.33
10 Charles A. Corbin	Michigan	Sept. 26, 1870	17	9	84.33	25.00	11.11	16.89	25.00	22.89	5.00	37.17	30.48	33.77	48.57	45.97	47.93	16.94	97.68	535.43
11 Moses L. Wood	Missouri	Sept. 21, 1871	17	1	55.92	16.47	20.44	9.78	39.17	15.00	8.67	31.76	30.71	33.77	48.57	45.97	47.93	16.94	111.24	577.40
12 James M. Helm	Tennessee	Sept. 29, 1871	15	9	66.00	21.18	13.00	12.00	28.33	21.67	7.33	40.59	41.81	52.00	40.69	55.56	55.56	10.58	104.40	526.72
13 Frederick W. Coffin	Massachusetts	June 15, 1870	17	4	86.17	26.18	16.44	10.29	40.00	23.67	7.83	38.68	39.41	52.00	40.69	55.56	55.56	10.58	103.30	526.37
14 Fredelio S. Carter	Illinois	Sept. 29, 1870	15	4	86.17	26.18	16.44	10.29	40.00	23.67	7.83	38.68	39.41	52.00	40.69	55.56	55.56	10.58	103.30	526.37
15 Harry M. Rogers	New York	Sept. 29, 1870	16	10	83.33	23.53	20.44	8.44	38.33	15.56	6.67	38.68	39.41	52.00	40.69	55.56	55.56	10.58	103.30	526.37
16 John A. Sheerman	New York	June 7, 1870	16	7	82.83	23.53	20.44	8.44	38.33	15.56	6.67	38.68	39.41	52.00	40.69	55.56	55.56	10.58	103.30	526.37
17 Alexander Sharp	Dist. of Columbia	June 20, 1870	14	7	82.83	23.53	20.44	8.44	38.33	15.56	6.67	38.68	39.41	52.00	40.69	55.56	55.56	10.58	103.30	526.37
18 Richard H. Worcester	Nebraska	Sept. 26, 1871	17	4	62.33	26.18	16.44	10.29	40.00	23.67	7.83	38.68	39.41	52.00	40.69	55.56	55.56	10.58	103.30	526.37
19 Edward H. Howes	New York	Sept. 26, 1871	14	3	47.67	14.12	20.44	20.44	38.33	15.56	4.47	30.56	30.56	30.56	30.56	30.56	30.56	13.89	98.04	467.97
20 Alfred L. Howe	South Carolina	Sept. 24, 1870	17	1	91.67	21.18	12.00	12.00	44.17	30.56	3.00	39.12	39.12	52.00	40.69	55.56	55.56	10.58	104.16	467.97
21 William G. Clark	Pennsylvania	Sept. 28, 1870	16	5	74.25	16.47	19.23	12.44	36.67	23.33	3.00	39.12	39.12	52.00	40.69	55.56	55.56	10.58	104.16	467.97
22 Robert M. Doyle	Tennessee	Sept. 21, 1870	16	10	40.33	12.35	12.00	12.00	44.17	30.56	3.00	39.12	39.12	52.00	40.69	55.56	55.56	10.58	104.16	467.97
23 David Danville	Massachusetts	Sept. 28, 1870	16	4	64.17	12.35	12.00	12.00	44.17	30.56	3.00	39.12	39.12	52.00	40.69	55.56	55.56	10.58	104.16	467.97
24 Augustus E. Farline	At large	Sept. 21, 1870	15	4	58.67	16.47	14.44	16.44	39.17	16.11	6.05	38.68	39.41	52.00	40.69	55.56	55.56	10.58	104.16	467.97
25 James S. Miley	Maine	Sept. 29, 1871	15	5	71.50	10.00	15.56	15.56	34.17	19.44	6.05	38.68	39.41	52.00	40.69	55.56	55.56	10.58	104.16	467.97
26 Harry J. Wells	Pennsylvania	Sept. 23, 1870	17	5	55.92	27.94	13.33	18.22	16.67	26.67	6.83	37.79	36.54	30.29	24.45	30.00	30.00	23.89	90.94	409.41
27 Allen T. Smith	North Carolina	Sept. 21, 1870	16	3	43.17	11.47	9.33	10.67	31.67	13.33	3.33	37.79	36.54	30.29	24.45	30.00	30.00	23.89	90.94	409.41
28 Frank E. Rutley	Missouri	Sept. 21, 1871	17	9	38.50	19.12	14.44	8.00	21.67	10.56	4.83	36.68	33.05	46.92	36.52	36.52	36.52	13.78	102.24	400.32
29 Frederick B. Vinton	New York	Sept. 20, 1871	16	9	43.50	13.34	12.89	13.78	20.83	14.44	4.83	36.68	33.05	46.92	36.52	36.52	36.52	13.78	104.16	397.84

UNITED STATES NAVAL ACADEMY.
Merrit-roll of the Second Class, (37 members,) annual examination, May, 1874—Continued.

Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Practical exercises in Seamanship.	Naval Tactics.	Ship-building.	Gunnery.	Infantry Tactics.	Fencing.	Astronomy.	Magnetism and Electricity.	Applied Mathematics and Mechanics.	Applied Mathematics.	French.	Drawing.	Conduct.	Aggregate.
			Years.	Months.															
32 William B. Caperton.....	Tennessee.....	June 5, 1871.....	15	11	26.67	(2.82)	17.33	11.56	20.00	12.22	8.00	18.53	17.31	38.39	31.03	35.56	21.39	117.72	394.43
33 Charles M. McCarthy....	Pennsylvania....	Sept. 23, 1869.....	15	1	44.92	10.39	8.67	8.69	17.50	10.00	3.58	23.82	(4.62)	21.14	21.38	57.78	25.56	105.00	363.45
334 George Stoney.....	Alabama.....	Sept. 20, 1870.....	17	11	52.25	19.12	9.78	9.33	19.17	16.67	4.50	20.29	(3.46)	34.56	32.41	21.11	18.06	102.12	363.13
35 Frank S. Collins.....	At large.....	Sept. 25, 1871.....	17	2	24.83	(9.41)	10.67	18.67	22.50	18.89	7.50	21.18	16.15	23.43	25.22	31.11	15.56	97.68	363.10
36 Ridgely Hunt.....	Louisiana.....	Sept. 20, 1870.....	16	7	52.25	25.00	8.67	13.33	15.83	11.67	3.17	15.88	(9.81)	26.56	28.28	24.44	24.44	102.48	362.11
37 Hunter C. White.....	Rhode Island....	June 11, 1870.....	16	5	33.00	26.82	8.00	15.11	15.00	25.00	7.00	17.21	(8.08)	31.43	(10.34)	25.56	16.94	100.44	341.93

UNITED STATES NAVAL ACADEMY.
Merit-roll of the Third Class, (56 members,) annual examination, May, 1874.

	Names in order of annual merit.	State.	Date of admission.		Years.	Age at admission.	Seamanship.	Ordnance Instruction.	Mechanical Drawing.	Mathematics.	Chemistry.	History and Composition.	Rhetoric.	French.	Drawing.	Conduct.	Aggregate.
			Months.	Years.													
1	Stimson J. Brown	New York	Sept. 16, 1873	17	73.06	43.77	5.60	147.73	42.50	32.15	39.67	60.00	42.30	535.00	535.00	535.00	535.00
2	Henry C. Gearing	Pennsylvania	June 12, 1873	17	62.95	41.96	6.18	150.00	43.73	32.58	37.33	55.74	42.30	535.00	535.00	535.00	535.00
3	Burns T. Walling	Ohio	June 5, 1873	17	64.92	46.79	7.35	138.64	43.73	30.46	37.92	53.62	41.91	44.50	476.65	476.65	476.65
4	James H. Sears	New York	Sept. 30, 1871	16	70.10	44.98	7.64	138.64	45.00	31.73	36.75	50.21	17.43	41.91	472.90	472.90	472.90
5	Edward M. Katz	Wisconsin	June 4, 1873	16	63.24	40.15	10.40	129.55	45.00	31.73	35.00	53.62	16.64	41.91	467.68	467.68	467.68
6	Templin H. Allen	At large	Sept. 30, 1873	16	68.14	48.00	7.35	138.64	36.35	29.19	39.08	54.89	7.81	41.31	466.00	466.00	466.00
7	William H. Allen	Illinois	Sept. 30, 1873	15	66.18	48.00	4.51	145.45	44.38	34.12	39.08	54.89	9.40	47.36	465.00	465.00	465.00
8	Walter McLean	At large	June 6, 1873	16	67.16	47.40	5.24	131.62	41.25	33.00	42.00	35.74	10.08	48.79	462.48	462.48	462.48
9	George C. Foulk	Pennsylvania	June 14, 1873	15	73.04	41.36	9.74	119.32	38.75	31.31	38.50	47.23	16.19	46.70	462.14	462.14	462.14
10	Clifford J. Boush	Tennessee	June 7, 1873	16	71.08	46.19	6.69	143.18	37.50	30.04	40.83	58.30	14.49	50.33	454.71	454.71	454.71
11	John T. Newton	Virginia	Sept. 30, 1871	14	65.94	37.13	8.07	125.00	35.63	37.08	41.42	56.00	15.69	46.42	449.10	449.10	449.10
12	Stephen Jenkins	New York	Oct. 14, 1873	17	62.94	38.34	11.71	197.37	41.88	37.92	32.67	59.00	16.87	43.45	434.61	434.61	434.61
13	Thomas G. Finch	Ohio	Sept. 30, 1873	14	55.88	38.34	11.71	103.41	31.88	35.81	30.33	35.74	11.89	43.35	406.96	406.96	406.96
14	L. K. Reynolds	Alabama	June 5, 1871	16	74.02	43.17	8.36	139.40	38.13	32.83	32.67	52.34	14.15	47.63	386.03	386.03	386.03
15	William L. Varnum	Pennsylvania	June 5, 1871	16	75.00	45.58	8.95	134.29	38.13	32.83	32.67	52.34	14.15	47.63	386.03	386.03	386.03
16	Anthony W. Rollins	Kentucky	June 10, 1873	17	57.35	39.49	5.89	139.00	18.13	32.42	27.42	38.30	13.36	43.45	392.61	392.61	392.61
17	Abraham E. Culver	New York	June 12, 1873	15	61.18	17.81	6.18	109.00	33.13	35.63	36.17	52.34	14.15	47.63	386.03	386.03	386.03
18	Charles F. Pond	Connecticut	June 12, 1873	16	41.18	31.70	10.04	113.64	35.63	32.58	37.02	17.77	29.56	37.02	48.65	384.13	384.13
19	James C. Gilmore	Pennsylvania	Sept. 30, 1871	17	55.88	40.75	12.00	103.41	32.50	31.95	25.38	32.34	14.49	48.65	384.13	384.13	384.13
20	Henry T. Mayo	Vermont	June 13, 1873	15	60.78	44.38	4.57	103.41	32.50	31.95	25.38	32.34	14.49	48.65	384.13	384.13	384.13
21	William Braunerreuther	Illinois	Sept. 23, 1871	17	60.78	42.57	6.18	103.41	32.50	31.95	25.38	32.34	14.49	48.65	384.13	384.13	384.13
22	Robert C. Ray	At large	Oct. 1, 1873	17	37.36	35.92	8.95	111.36	33.75	26.65	20.71	32.34	7.81	49.73	366.29	366.29	366.29
23	Charles A. Gave	New Hampshire	June 5, 1871	16	58.33	32.60	11.30	97.73	31.25	26.65	20.71	32.34	7.81	49.73	366.29	366.29	366.29
24	A. C. Macomb	At large	Sept. 24, 1873	17	50.49	32.60	10.91	62.50	40.63	19.83	32.08	48.09	9.40	38.08	342.66	342.66	342.66
25	Richard Henderson	North Carolina	Sept. 28, 1873	17	45.10	19.63	7.35	103.41	35.00	16.08	19.83	32.34	14.83	43.18	337.58	337.58	337.58
26	John M. Proudit	At large	Sept. 24, 1873	17	46.57	33.51	10.04	88.64	18.75	16.08	19.83	32.34	14.83	43.18	337.58	337.58	337.58
27	Waldemar D. Rose	At large	June 5, 1873	15	48.04	29.80	7.05	77.37	37.38	23.27	23.07	28.94	12.34	50.05	330.15	330.15	330.15
28	Francis H. Sherman	Missouri	Sept. 20, 1871	16	43.63	31.09	11.56	75.00	37.50	23.27	23.07	28.94	12.34	50.05	330.15	330.15	330.15
29	Daniel R. Case	At large	June 5, 1873	15	52.94	23.85	7.85	90.91	38.75	23.27	23.07	28.94	12.34	50.05	330.15	330.15	330.15
30	William G. Hannum	Pennsylvania	Sept. 23, 1873	16	49.51	25.66	8.95	82.95	38.75	23.27	23.07	28.94	12.34	50.05	330.15	330.15	330.15
31	De Witt Coffman	Virginia	June 6, 1873	17	52.94	38.94	5.60	69.50	30.63	19.04	14.87	33.57	11.32	54.45	319.86	319.86	319.86
32	William S. Hogg	At large	Sept. 24, 1873	15	48.04	31.43	10.69	95.45	30.63	19.04	14.87	33.57	11.32	54.45	319.86	319.86	319.86
33	L. W. Piepmeyer	At large	Sept. 22, 1871	17	33.82	34.73	6.47	(45.45)	16.88	13.54	98.77	40.25	45.71	313.92	313.92	313.92	313.92
34	N. J. L. T. Halpine	New York	June 9, 1871	14	69.12	38.08	11.30	(38.64)	19.38	13.54	98.77	40.25	45.71	313.92	313.92	313.92	313.92

UNITED STATES NAVAL ACADEMY.
Merit-roll of the Fourth Class, (98 members,) annual examination, May, 1874.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Mathematics.	Grammar.	History and Composition.	French.	Conduct.	Aggregate.
				Years.	Months.						
* 1	William F. Fullam	New York	Sept. 24, 1873	17	11	117.38	90.73	42.00	24	15	231
* 2	Horace M. Witzel	Wisconsin	June 5, 1873	15	14	120.00	89.45	42.00	21.87	14.87	935.85
* 3	Albert G. Witherthal	Michigan	Sept. 29, 1873	16	11	113.44	89.45	40.34	20.10	14.01	927.98
* 4	August F. Fendler	New York	June 1, 1873	15	0	113.69	88.44	38.58	23.63	14.30	913.49
* 5	August H. Oliver	Georgia	June 12, 1873	16	0	118.12	85.80	37.92	23.13	13.33	917.19
* 6	William V. Bransh	Kentucky	Sept. 24, 1873	17	9	116.07	86.90	39.42	23.30	13.55	913.65
* 7	George F. Ormsby	Ohio	Sept. 24, 1873	17	4	104.90	87.53	41.86	17.88	12.36	912.92
* 8	Valentino S. Nelson	Tennessee	June 6, 1873	17	5	109.51	85.07	39.70	18.03	14.16	907.18
* 9	John M. Orchard	Missouri	June 11, 1873	15	9	114.73	86.71	36.43	16.75	14.64	905.76
* 10	Frank M. Beatrick	Wisconsin	Sept. 26, 1873	16	5	109.67	87.96	36.47	21.55	11.94	900.94
* 11	John N. Jordan	Maine	June 5, 1873	17	8	106.99	83.79	37.81	21.84	19.77	897.72
* 12	Charles S. Williams	Wisconsin	June 19, 1873	16	9	110.89	119.59	38.74	15.04	11.18	892.56
* 13	Henry C. Jones	Maine	Sept. 28, 1873	17	1	92.62	30.00	40.49	22.09	14.85	136.44
* 14	William G. Davis	New York	Sept. 28, 1873	17	2	97.70	87.81	33.87	15.70	13.14	136.81
* 15	Onesmo B. Dodge	Kansas	June 13, 1873	17	0	104.92	81.78	34.35	13.97	14.67	139.00
* 16	Edward B. Mosinger	Massachusetts	Sept. 26, 1873	16	7	104.92	82.05	37.86	22.83	11.10	138.16
* 17	Edward E. Wright	Massachusetts	Sept. 30, 1873	16	7	104.92	82.05	37.86	22.83	11.10	138.16
* 18	Arthur W. Davis	Indiana	June 6, 1873	16	0	76.72	85.34	40.34	20.69	14.60	180.71
* 19	Benjamin W. Hodges	Mississippi	Sept. 29, 1873	16	10	99.67	85.34	31.37	18.84	14.06	178.69
* 20	Alfred J. Rogers	Texas	Sept. 29, 1873	17	9	79.34	89.63	32.05	17.83	14.71	178.61
* 21	Sam E. Woodworth	At large	June 9, 1873	17	5	92.46	80.14	33.05	16.43	14.70	176.98
* 22	Albert Graves	Tennessee	Sept. 30, 1873	15	5	85.80	33.83	33.83	23.45	10.80	176.83
* 23	David W. Jones	Tennessee	June 9, 1873	15	5	85.49	33.16	33.00	19.48	12.35	176.45
* 24	William B. Wood	Pennsylvania	June 8, 1873	16	7	85.08	17.19	32.40	18.30	11.37	173.02
* 25	Albert N. Osterhout	Ohio	June 9, 1873	17	8	105.64	19.74	32.47	18.38	10.88	173.61
* 26	James P. Parker	Indiana	Sept. 24, 1873	17	9	85.90	34.52	36.41	18.41	11.71	171.60
* 27	Walter Hodges	North Carolina	June 5, 1873	16	9	71.48	63.90	36.54	18.68	14.97	170.77
* 28	William Green	Georgia	June 12, 1873	15	11	82.62	35.02	33.00	22.40	11.94	170.09
* 29	Hiero Taylor	Texas	Sept. 28, 1873	17	10	98.52	32.70	37.85	22.40	13.97	167.78
* 30	Thomas M. Brumby	Illinois	Sept. 28, 1873	17	10	78.03	32.42	34.63	14.39	12.73	164.68
* 31	James W. Sheeks	Georgia	Sept. 24, 1873	15	0	90.49	15.75	35.03	20.16	14.13	164.50
* 32	Abner W. Grant	Texas	June 4, 1873	17	1	92.47	14.11	35.03	20.16	10.47	161.92
* 33	Harry W. Dombagh	Wisconsin	June 8, 1873	16	4	96.39	11.59	30.63	11.54	13.37	157.41
* 34	Walter M. Constant	Indiana	June 13, 1873	16	3	72.44	20.90	20.63	10.99	12.42	156.46
* 35	Keizero Nachida	Empire of Japan	Oct. 14, 1873	16	4	102.95	10.27	18.79	14.72	11.33	154.90

UNITED STATES NAVAL ACADEMY.

Merit-roll of the Fourth Class, (98 members,) annual examination, May, 1874—Continued.

Names in order of annual merit.		State.	Date of admission.	Age at date of admission.		Mathematics.	Grammar.	History and Composition.	French.	Conduct.	Aggregate.
				Years.	Months.						
36	William S. Benson	Georgia	Sept. 21, 1873	16	11	69.51	92.88	97.63	15.79	13.89	149.70
37	Jonathan K. Bryce	Ohio	June 13, 1873	17		75.41	93.15	97.53	12.48	11.31	145.93
38	Horace W. Harrison	At large	Sept. 24, 1873	16	9	52.46	94.25	93.42	93.57	10.58	143.98
39	William C. Riorden	Nevada	Sept. 23, 1873	16	9	44.59	95.08	41.63	18.88	(0.86)	143.04
40	Russel C. Paris	New York	Sept. 23, 1873	14	1	80.66	17.67	(11.42)	17.71	14.92	141.68
41	Frank B. Case	Michigan	June 7, 1873	15	7	85.90	14.66	17.32	8.00	12.08	137.96
42	Percival J. Werlich	Wisconsin	June 16, 1873	16	4	65.57	17.95	32.79	8.21	12.15	136.67
43	Frank S. Buckley	Michigan	Sept. 26, 1873	15	11	63.61	91.51	92.47	10.13	13.80	131.52
44	Oliver J. Schoolcraft	Massachusetts	June 7, 1873	17	7	65.57	11.10	21.00	91.55	(10.32)	129.54
45	Arthur B. Frenzel	Virginia	June 5, 1873	17	10	42.62	90.68	30.95	91.12	13.90	129.57
46	William R. Rush	Louisiana	June 6, 1873	14	8	73.44	11.37	16.58	15.79	10.50	137.68
47	Frank R. Heath	At large	Sept. 23, 1873	16	4	55.08	14.38	23.21	20.69	14.28	137.64
48	John H. McNasser	Wyoming Territory	June 8, 1873	15	0	57.05	13.19	24.68	19.41	12.45	125.78
49	Herbert O. Dunn	Rhode Island	June 6, 1873	16	0	49.18	20.41	30.31	11.20	14.18	125.18
50	William L. Burdick	Ohio	Sept. 26, 1873	16	9	52.46	18.22	26.80	13.12	13.37	134.06
51	Henry H. Rogers	Illinois	June 13, 1873	17	9	44.59	24.79	26.53	13.44	14.39	123.74
52	Phillip V. Lansdale	At large	June 6, 1873	15	3	59.67	14.84	25.42	9.60	15.00	123.53
53	George W. Denfold	Massachusetts	Sept. 26, 1873	17	1	60.98	15.21	22.11	11.84	13.35	123.49
54	William F. Endress	New York	Sept. 25, 1873	17	1	46.56	21.23	29.84	10.35	14.67	122.65
55	Thomas B. Maynadler	At large	June 10, 1873	16	9	58.36	10.82	22.84	20.16	(10.31)	122.49
56	Simon Cook	Missouri	June 6, 1873	16	11	69.51	11.92	13.63	12.48	14.85	122.39
57	Lewis C. Fletcher	Pennsylvania	June 14, 1873	16	1	62.30	10.95	(13.63)	14.72	12.65	119.38
58	Harry C. Wakenshaw	New York	June 10, 1873	16	6	38.69	19.86	31.32	14.29	14.18	112.34
59	Arthur B. Tracy	New Jersey	June 5, 1873	16	10	(32.13)	18.49	28.37	22.83	14.34	116.16
60	Thomas W. Ryan	Pennsylvania	June 13, 1873	16	11	(37.38)	16.85	28.00	21.12	12.74	116.09
61	John C. Wilson	New York	Sept. 25, 1873	16	3	43.18	15.48	16.31	18.45	10.64	109.96
62	Frank W. Toppan	Massachusetts	Sept. 23, 1873	17	9	49.18	14.93	18.42	11.41	14.19	103.13
63	Charles N. Atwater	New York	Sept. 24, 1873	16	3	(36.07)	19.32	28.74	9.92	14.01	103.06
64	William C. Canfield	At large	Sept. 23, 1873	16	1	(39.51)	18.77	32.05	13.44	13.97	107.74
65	Mark C. Castle	Minnesota	Sept. 23, 1873	16	9	55.08	16.30	15.64	8.43	10.74	106.39
66	Austin D. Carrington	Virginia	Sept. 23, 1873	17	5	(30.82)	16.58	21.74	16.73	12.90	97.77
67	John H. W. Carrington	North Carolina	June 5, 1873	15	3	(34.10)	11.64	20.36	11.42	12.30	97.15
68	John H. W. Carrington	At large	Sept. 23, 1873	17	5	40.68	(9.73)	18.05	9.28	12.66	90.38
69	Richard W. Parker	Malta	Sept. 23, 1873	17	0	(40.68)	13.01	15.47	9.60	(10.40)	89.14
70	George H. Hays	Michigan	Sept. 23, 1873	17	7	(28.29)	10.00	26.16	8.96	12.21	85.53

71	Robert P. Fauntleroy	At large.	Sept. 23, 1873	16	5	(30.33)	17.40	16.95	15.25	12.09	62.09
72	Robert K. Wright	Pennsylvania	June 10, 1873	14	6	(24.36)	12.47	19.89	12.91	11.75	81.29
73	William Bancroft	Minnesota	June 5, 1873	14	7	(34.10)	19.45	(12.89)	(6.51)	12.41	72.36
74	Marian A. Vinton	At large.	June 5, 1873	13	11	(7.21)	13.59	17.02	17.71	14.76	70.65
75	Henry B. Lindley	Ohio	June 5, 1873	17	7	(12.36)	13.56	19.33	(7.57)	10.65	69.67
76	William E. W. Hall	Maryland	June 14, 1873	17	3	(26.89)	(8.90)	(11.79)	10.50	10.86	69.00
77	Thomas Dickinson	Kentucky	Sept. 23, 1873	15	5	(9.18)	19.04	14.00	10.77	10.82	63.81
78	Thomas L. Biudgett	Pennsylvania	Sept. 26, 1873	15	4	(22.05)	(8.36)	(12.16)	(5.44)	13.59	62.50
79	John G. Mason	Ohio	June 5, 1873	17	6	(25.57)	(7.53)	(11.05)	(4.80)	12.30	61.25
80	Charles H. Walsh	At large.	June 12, 1873	16	4	(5.90)	(9.18)	25.79	(5.65)	13.89	60.41
81	Sammel L. Heap	Georgia	Nov. 4, 1872	15	10	(18.36)	(6.99)	14.74	8.96	(10.16)	59.21
82	John L. Purcell	New Jersey	Sept. 29, 1873	17	4	(16.39)	(8.08)	14.37	(3.87)	14.48	59.19
83	Wilson L. Todd	Pennsylvania	June 5, 1873	15	1	(21.64)	(7.90)	(9.58)	(7.27)	11.33	57.06
84	Thomas G. Harkness	Pennsylvania	Apr. 21, 1873	17	11	(14.43)	(6.71)	(10.68)	(4.59)	10.62	47.03
85	William K. Stevens	New York	Sept. 29, 1873	16	7	(11.15)	(8.47)	(6.85)	13.80	16.80	46.41
86	Francis S. Goulding	Pennsylvania	June 7, 1873	17	9	(4.59)	(8.63)	15.11	(4.16)	11.55	44.04
87	Ezra P. Sanders	California	Sept. 22, 1873	15	3	(12.46)	(5.62)	(12.53)	8.64	(4.76)	44.01
88	Robert M. Donovan	Oregon	June 13, 1873	17	6	(3.39)	(7.25)	(10.39)	(7.25)	10.85	37.59
89	Maurice O. Bunn	North Carolina	Sept. 24, 1873	14	10	(9.18)	(7.81)	(9.21)	(6.85)	(4.19)	37.22
90	Howard S. Holmes	California	June 5, 1873	17	5	(0.66)	(5.34)	(9.95)	(6.29)	11.03	33.37
91	Weber Vinson	At large.	Sept. 30, 1873	17	5	(-0.65)	(6.44)	(8.84)	(3.95)	11.72	30.20
	John Ancona	Pennsylvania	Sept. 29, 1873	15	11	(14.43)	a	(13.26)	(5.19)	13.41	a
	John D. Chase	Georgia	Sept. 29, 1873	17	15	a	a	a	a	13.91	a
	Baine C. Dent	At large.	June 5, 1873	15	7	a	a	a	a	10.38	a
	Walter C. Hagar	Massachusetts	Oct. 3, 1873	16	10	a	a	a	a	14.34	a
	John A. Lockwood	Maryland	Sept. 26, 1873	16	10	(-1.95)	a	a	a	14.78	a
	Richard H. Lull	Illinois	Sept. 23, 1873	16	3	(3.26)	a	a	a	(4.37)	11.49
	Bushrod W. Taylor	At large.	Sept. 20, 1873	14	7	(1.97)	a	a	a	14.60	a

UNITED STATES NAVAL ACADEMY.

Merit-roll of the First Class, Cadet-Engineers, (14 members), annual examination, May, 1874, and general merit-roll for two years.

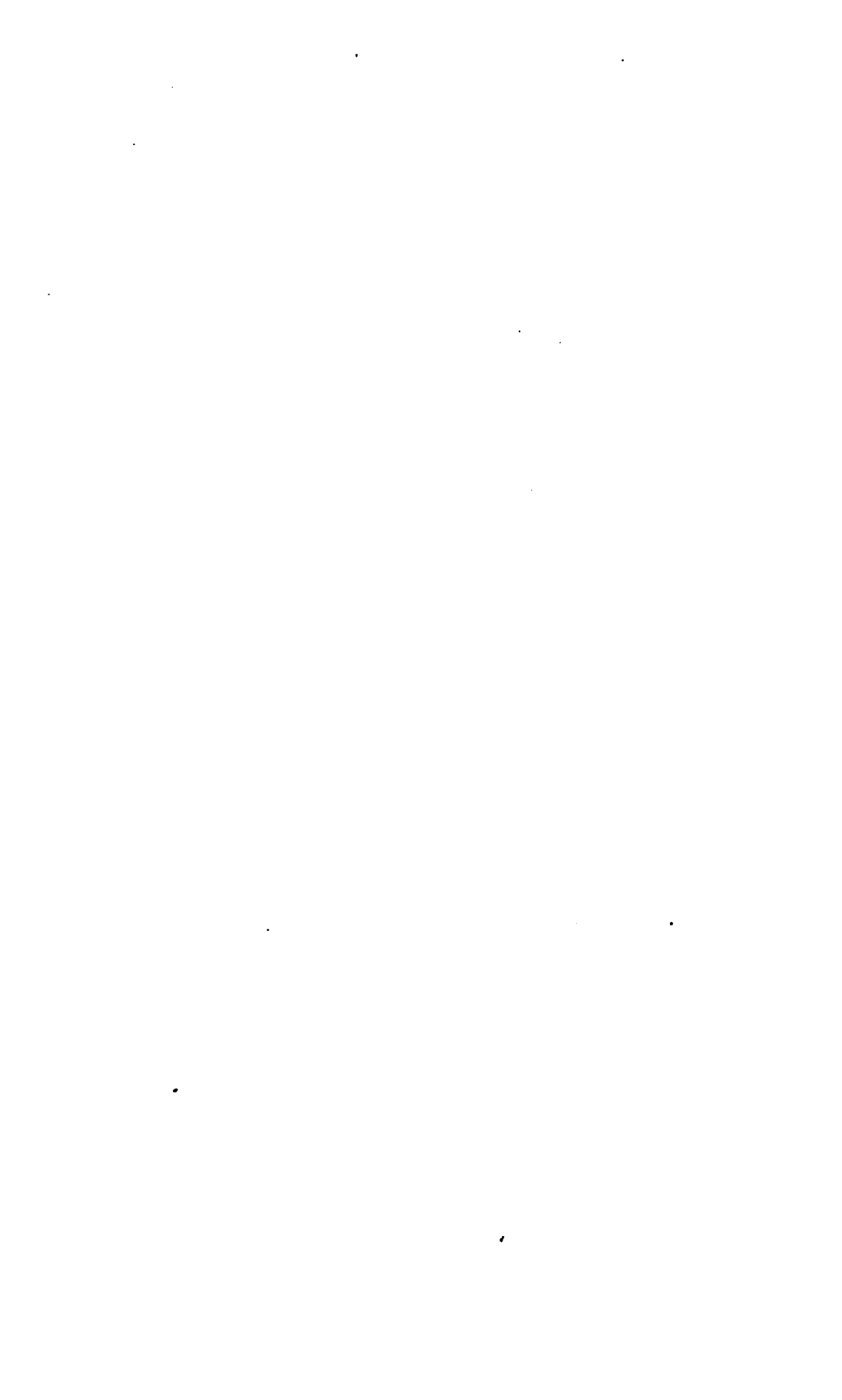
Names in order of general merit.	State.	Date of admission.	Age at date of admission.		Electricity.	Chemistry.	Applied Mathematics.	French.	Applied Mathematics and Mechanics.	Heat.	Steam.	Conduct.	Aggregate for second year.	Aggregate for first year.	Aggregate for two years.
			Years.	Months.											
*1 Asa Mattice.....	New York.....	Oct. 1, 1872	19	2	45.00	96.46	60.00	36.00	60.00	45.00	198.00	150.00	690.46	287.52	977.98
*2 George B. Ransom.....	New York.....	Oct. 1, 1871	20	3	34.09	73.62	30.00	30.00	34.55	18.00	157.38	142.05	519.69	336.06	855.75
*3 William C. Eason.....	New York.....	Oct. 1, 1872	21	7	31.36	96.46	50.00	39.00	56.36	42.00	106.61	145.50	567.59	268.60	835.69
*4 Frank J. Hoffman.....	Maryland.....	Oct. 1, 1872	19	11	42.27	83.77	45.00	45.00	52.73	30.00	147.23	144.90	590.90	240.99	831.89
*5 Alfred B. Canaga.....	Ohio.....	Oct. 1, 1872	21	9	28.64	86.85	55.00	33.00	49.09	31.00	96.46	150.00	522.04	264.69	806.73
*6 Abram V. Zane.....	Pennsylvania.....	Oct. 1, 1871	21	1	17.73	45.15	30.00	24.00	38.91	39.00	167.54	140.70	483.03	306.07	789.10
*7 John R. Edwards.....	Pennsylvania.....	Oct. 1, 1871	21	12	30.45	63.46	40.00	27.00	38.18	33.00	126.92	147.75	502.92	268.90	771.21
*8 Benjamin H. Warren.....	Massachusetts.....	Oct. 1, 1871	21	1	30.45	78.69	45.00	27.00	30.00	27.00	177.69	143.85	493.68	270.07	763.15
*9 Albert B. Willits.....	Pennsylvania.....	Oct. 1, 1872	21	6	39.55	56.38	25.00	19.00	41.82	36.00	137.05	147.75	494.58	302.54	757.13
*10 Stacy Potts.....	Pennsylvania.....	Oct. 1, 1871	19	7	36.82	46.23	35.00	15.00	45.45	24.00	187.85	145.50	532.75	161.28	694.03
*11 Charles Kleckner.....	Pennsylvania.....	Oct. 1, 1871	18	7	23.18	66.54	(0.00)	(12.00)	27.27	(6.00)	116.77	145.50	389.36	211.02	610.28
*12 William B. Boggs.....	District of Columbia.....	Oct. 1, 1871	19	31	(0.55)	38.08	(5.00)	42.00	12.73	(12.00)	86.31	144.30	339.97	245.95	585.92
*13 Edgar T. Warburton.....	Pennsylvania.....	Oct. 1, 1872	17	3	15.00	33.00	(15.00)	18.00	23.64	(9.00)	66.00	141.45	321.09	196.42	507.51
*14 Frank H. Eldridge.....	Ohio.....	Oct. 1, 1872	20	2	(12.27)	53.31	(10.00)	(6.00)	16.36	15.00	76.15	145.05	334.14	162.28	496.42

UNITED STATES NAVAL ACADEMY.

Merit-roll of the Second Class, Cadet-Engineers, (20 members,) annual examination, May, 1874.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Mathematics.	Steam.	French.	Conduct.	Aggregate.
				Years.	Months.					
*1	William R. King.....	Maryland.....	Oct. 1, 1872	19	9	141.67	80.44	43.71	48.13	313.95
*2	Frank H. Bailey.....	Pennsylvania.....	Oct. 1, 1873	22	3	150.00	99.00	(7.59)	54.18	310.47
*3	George S. Willits.....	Pennsylvania.....	Oct. 1, 1873	20	6	133.33	66.00	46.14	53.30	298.77
*4	William Cowles.....	New York.....	Oct. 1, 1873	18	7	125.00	90.75	29.14	53.46	298.35
*5	William L. Cathcart.....	Connecticut.....	Oct. 1, 1873	18	1	100.00	94.88	36.43	53.00	295.31
*6	William N. Little.....	Georgia.....	Oct. 1, 1872	19	8	108.33	86.63	34.00	47.19	276.15
*7	Edward R. Freeman.....	Mississippi.....	Oct. 1, 1873	19	9	116.67	53.63	38.56	52.64	261.80
*8	Alberto de Ruiz.....	Pennsylvania.....	Oct. 1, 1873	20	5	83.33	74.25	51.00	46.20	254.78
*9	Walter F. Worthington.....	Maryland.....	Oct. 1, 1873	18	6	91.67	57.75	48.57	52.69	250.68
*10	Theodore F. Burdett.....	New Jersey.....	Oct. 1, 1873	18	9	75.00	70.13	41.29	55.00	241.42
*11	Edmund U. Loomis.....	Maryland.....	Oct. 1, 1872	21	3	50.00	61.88	19.43	53.90	185.21
*12	George H. T. Babbitt.....	Ohio.....	Oct. 1, 1873	17	2	58.33	45.38	29.14	46.53	179.38
*13	Henry H. Stivers.....	New York.....	Oct. 1, 1873	18	0	(16.67)	80.44	(14.57)	50.66	162.34
*14	George L. Drouillard.....	Ohio.....	Oct. 1, 1872	19	5	66.67	37.13	(9.71)	48.62	162.13
*15	William B. Dunning.....	New York.....	Oct. 1, 1873	19	2	(41.67)	46.50	17.00	50.37	158.44
*16	Loring Olmsted.....	New York.....	Oct. 1, 1873	18	3	(35.00)	41.25	29.14	44.33	139.72
*17	Robin J. Reid.....	Pennsylvania.....	Oct. 1, 1872	20	2	(33.33)	33.00	21.86	48.79	136.98
*18	Charles N. Johnson.....	Missouri.....	Oct. 1, 1873	18	2	0.00	34.75	24.29	50.99	100.03
*19	Gordon H. Clande.....	Maryland.....	Oct. 1, 1873	18	11	(8.33)	26.88	(12.14)	44.66	94.01
*20	Harry Eastman.....	District of Columbia.....	Oct. 1, 1873	20	9	a	a	a	a	a

REQUISITES FOR ADMISSION
AND
COURSE OF INSTRUCTION,
WITH
EXAMINATION-PAPERS.



REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

I. The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; and ten appointed annually at large.

II. The nomination of candidates for admission from the District of Columbia, and at large, is made by the President. The nomination of a candidate from any congressional district or Territory is made on the recommendation of the Member or Delegate from actual residents of his district or Territory.

III. Each year, as soon after the 5th of March as possible, Members and Delegates will be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress.

IV. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy between the 5th and 8th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the June examination, will be examined between the 20th and 23d of September following; and should any candidate fail to report, or be found physically or mentally disqualified for admission in June, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined between the 20th and 23d of September following.

V. No candidate will be admitted into the Naval Academy, unless he shall have passed a satisfactory examination before the Academic Board, and is found, in the opinion of a medical board, to be composed of the surgeon of the Naval Academy and two other medical officers designated by the Secretary of the Navy, in all respects physically sound, well-formed, and of robust constitution, and qualified to endure the arduous labors of an officer in the Navy.

VI. Candidates for appointment as Cadet-Midshipmen must be between fourteen and eighteen years of age when examined for admission. All candidates for admission will be required to certify *on honor* to their precise age, to the Academic Board, previous to examination, and none will be examined who are over or under the prescribed age. They must be of good moral character, satisfactory testimonials of which, from persons of good repute in the neighborhood of their respective residences, must be presented; and testimonials from clergymen and instructors in colleges and high schools will have special weight. They must also pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar, viz: in reading, they must read clearly and intelligibly from any English narrative work, as, for example, Bancroft's History of the United States; in writing and spelling, they must write from dictation, in a legible hand, and spell with correctness, both orally and in writing; in arithmetic, they will be examined in numeration, and the addition, subtraction, multiplication, and division of whole numbers and vulgar and decimal fractions, and in proportion, or the rule of three, and show a good knowledge of the subject. It is desirable that the board should ascertain the aptitude of a candidate in this branch of study, which, if good, should count in his favor in case of a slight deficiency in other

branches. In *geography*, candidates will be examined as to the grand divisions, the continents, oceans, and seas, the chief mountains and rivers, and the boundaries and population of the chief nations, their governments, capitals, and chief cities; in *English grammar*, they will be examined as to the parts of speech, the rules connected therewith, and the elementary construction of sentences, and will be required to write such original paragraphs as will show that they have a proper knowledge of the subject.

The board will judge whether the proficiency of the candidate in these branches is sufficient to qualify him to enter upon the studies of the Academy.

VII. Any one of the following conditions will be sufficient to reject a candidate:—

Feeble constitution; permanently impaired general health; decided cachexia; all chronic diseases, or results of injuries that would permanently impair efficiency, viz.,—

1. Infectious disorders.
2. Weak or disordered intellect.
3. Unnatural curvature of spine.
4. Epilepsy, or other convulsions, within five years.
5. Impaired vision, or chronic disease of the organs of vision.
6. Great permanent hardness of hearing, or chronic disease of the ears.
7. Loss or decay of teeth to such an extent as to interfere with digestion and impair health.
8. Impediment of speech to such an extent as to impair efficiency in the performance of duty.

9. Decided indications of liability to pulmonary disease.

10. Permanent inefficiency of either of the extremities.

11. Hernia.

12. Incurable sarcocele, hydrocele, fistula, stricture, or hemorrhoids.

13. Large varicose veins of lower limbs. Chronic ulcers.

14. Attention will also be paid to the stature of the candidate; and no one manifestly undersized for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

15. The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

VIII. If both these examinations result favorably, the candidate will receive an appointment as a midshipman, become an inmate of the Academy, and be allowed his actual and necessary traveling-expenses from his residence to the Naval Academy, and be required to sign articles by which he will bind himself to serve in the United States Navy eight years, (including his term of probation at the Naval Academy,) unless sooner discharged. If, on the contrary, he shall not pass both of these examinations, he will receive neither an appointment nor his traveling-expenses; nor can he by law have the privilege of another examination for admission to the same class unless recommended by the Academic Board.

IX. When candidates shall have passed the required examinations and been admitted as members of the Academy, they must immediately furnish themselves with the following articles, viz.,—

One parade-suit	\$37 72	* One pair low shoes	5 90
One undress-suit	15 79	One pair gymnastic slippers	1 22
One working-suit	3 63	* Eight white shirts	16 00
One overcoat	22 80	* Two night-shirts	3 00
One rubber coat	5 52	* Four undershirts	2 52
One parade-cap	3 95	Twelve linen collars	1 80
One undress-cap	1 75	* Eight pairs socks	2 00
* One pair high shoes	6 25	Four pairs drawers	3 00

*Six handkerchiefs.....	\$2 04	*One tooth-brush	\$0 25
*Eight towels	2 00	*One hair-brush.....	80
Two pairs drill-gloves.....	1 32	*One whisk.....	30
Two pairs Lisle-thread gloves.....	72	*One coarse comb	34
*One pair suspenders.....	46	*One fine comb	30
One silk handkerchief.....	77	One mug	13
One neck-tie.....	84	*One cake soap	10
Two clothes-bags	70	One soap-dish.....	14
One hair mattress.....	10 71	One requisition-book	44
One straw mattress	1 58	One laundry-book	48
One hair pillow.....	1 58	One pass-book	47
One pair blankets.....	4 12	One stencil and ink	23
Two bed-spreads.....	2 84	*One thread and needle-case.....	53
Six sheets	5 25	One rug	1 86
Four pillow-cases	1 24	One wash-basin.....	1 36

Room-mates will procure for their common use—

One looking-glass, (half-cost).....	\$0 75	One broom, (half-cost)	\$0 20
One water-pail, (half-cost)	53	One table-cover, (half-cost).....	75
One slop-bucket, (half-cost)	66		

Total 179 64

The articles marked *, not being required to conform to a standard pattern, may be brought by the Cadet from his home, but all other articles must conform to the regulations, and are therefore required to be supplied by the Store-keeper.

X. Each cadet-midshipman must, on admission, deposit with the paymaster the sum of \$100, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, for the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing, and the entrance-deposit of one hundred dollars, must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing	\$179 64
Deposit for books, &c.....	100 00
Total deposit required	279 64

The value of clothing brought from home is to be deducted from this amount.

Each cadet-midshipman, one month after admission, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XI. A cadet-midshipman found deficient at any examination cannot, by law, be continued at the Academy or in the service, unless upon the recommendation of the Academic Board, and it will be useless to apply to the Secretary of the Navy, who will decline to interfere in the matter.

XII. A cadet-midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling-expenses.

A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting appointments and attempting to enter a service for which they are not fitted.

GEO. M. ROBESON,
Secretary of the Navy.

GENERAL CHARACTER OF THE QUESTIONS PROPOSED AT THE EXAMINATION OF CANDIDATES FOR ADMISSION TO THE UNITED STATES NAVAL ACADEMY AS CADET-MIDSHIPMEN.

ARITHMETIC.

NOTATION AND NUMERATION.—The candidate is required to express in figures any whole number, decimal, or mixed number, to write in words any given number, and to explain the Roman and Arabic systems of notation.

DENOMINATE NUMBERS.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

FRACTIONS.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such processes, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

PROPERTIES OF NUMBERS.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

RATIO AND PROPORTION.—Definitions, and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

ANALYSIS.—Miscellaneous problems, usually classed under the head of analysis, or mental arithmetic.

The candidate will be required to perform examples under any or all of the above heads. Questions are to be answered first in writing, and if the written examination is not decisive, an oral examination is added.

GEOGRAPHY.

Candidates will be questioned on,—

The grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains, and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance; (attention is specially called to the rivers and bodies of water on which cities are situated;) the course of a vessel in making a voyage between wellknown sea-ports.

GRAMMAR.

Candidates will be examined in the whole of English grammar, as treated in the common-school text-books, embracing the following subjects: The divisions of letters, and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *gender*, the three ways of distinguishing sex; under *number*, the rules for the formation of the plural, nouns irregular and defective

in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for comparing adjectives; irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives, secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as the difference between *my* and *mine*, between *thou* and *you*, and the various uses of it; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs*; the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflexion of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs*; conjunctive adverbs; the use of *prepositions*, *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under *syntax*.

Parsing, according to the following model:

NOUN: Class, gender, number, person, case.

ARTICLE: Definite or indefinite; qualified noun.

ADJECTIVE: Class; compared or not compared; comparison, if admitting it; degree of comparison; qualified noun.

PERSONAL PRONOUN: Person, gender, number, case.

RELATIVE PRONOUN: Person, gender, number, case, antecedent.

INTERROGATIVE PRONOUN: Gender, number, case.

ADJECTIVE PRONOUN, (or pronominal adjective): Class; qualified word.

VERB: Class, form, principal parts, tense, mood, voice, person, number, subject.

ADVERB: Class; derivation and comparison, if derived and compared; qualified word.

PREPOSITION: Words between which the relation is shown by the preposition.

INTERJECTION: The kind of emotion expressed.

CONJUNCTION: Class; words or sentences connected.

The construction of the word will be required in all cases.

READING.

Candidates will be examined in reading aloud English prose, in a standard work; for example, Bancroft's History of the United States.

WRITING AND SPELLING.

Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use. An exercise containing less than eight mistakes in spelling will be considered satisfactory in this respect.

The following words were given in June, 1874:

Engineer.	Physician.	Necessary.	Referred.
Artillery.	Exquisite.	Delegate.	Sympathy.
Beautify.	Photograph.	Militia.	Excellent.
Linen.	Colonel.	Chemistry.	Essential.
Auxiliary.	Emphasis.	Parallel.	Splendor.
Malicious.	Academy.	Judicious.	Trustworthy.

If the written examination is not decisive, an oral examination is added.

Time allowed for examination in English branches, three hours.

ARITHMETIC.

JUNE 8, 1874.—Time allowed, five hours.

N. B.—The starred questions are not required, but any one or all of them may be substituted for an equal number of the first ten questions.

1. Reduce $\frac{99188888}{100000000}$ to a decimal. Reduce 0.001264 to a common fraction in its lowest terms. Divide 0.00041097 by 2163. Divide 547723 by 0.000493. Reduce $\frac{2177777}{100000000}$ to a decimal.

2. Reduce the following expression to its simplest form—

$$\frac{4\frac{1}{2} + \frac{3\frac{1}{2}}{5} - \frac{2}{3} + \frac{\frac{4}{5}}{1\frac{1}{2}}}{\frac{2\frac{1}{2}}{3} \text{ of } 2\frac{1}{2} - 3\frac{1}{2} + \frac{1}{2} \text{ of } 1\frac{1}{2}} + 1\frac{1}{2} + \frac{1}{2} \text{ of } \frac{1}{2} - 9\frac{1}{2}$$

3. Find the value of 0.074609375 of £10 13s. 4d.

4. Resolve each of the following numbers into its prime factors: 1001, 3135, 1183, and 529. How can we determine by inspection whether a number is exactly divisible by 3, 5, 9, 25, or 125? Express the decimal 0.428571428571 as a common fraction.

5. Sound travels at the rate of 1142 feet per second. If a gun be fired at a distance of $4\frac{1}{2}$ miles, how long after the flash will the sound be heard?

6. Six thousand eight hundred dollars is divided between A, B, and C, so that A's share is $\frac{2}{3}$ of B's, and B's share is $\frac{2}{3}$ of C's; how much does each receive?

7. A city lot, 50 feet by 75 feet, is sold for \$7500.00; how much does it cost per acre?

8. A contractor has a piece of work which must be done in 18 days, and can be done in this time by 160 men, whom he has in his employ, working 10 hours a day. After working 6 days, they strike for 8 hours as a day's work. After 2 days the contractor yields; how many more men must he employ that the work may be finished in 18 days from the beginning, the new men also working 8 hours a day?

9. Suppose the alloy in a silver dollar to be $\frac{1}{10}$ of its mass, and the coin to be worth five cents if it were all alloy, what would be its value if it were all pure silver?

10. A train 88 yards in length overtook a person walking along the line at the rate of 4 miles an hour, and passed him in 10 seconds. Twenty minutes after, the train overtook another person, and passed him in 9 seconds. When did the first person overtake the last?

1*. Extract the square root of 0.049. Simplify—

$$16 - \{5 - 2x - [1 - (3 - x)]\}$$

What are the factors of $4a^2 - 9c^2$? of $x^2 + 9x + 20$? of $x^3 + 8$?

2*. Solve the equation—

$$\frac{x-1}{4} - \frac{x-5}{32} + \frac{15-2x}{40} = \frac{9-x}{2} - \frac{7}{8}$$

Multiply—

$$x^{2n+1} + y^{2n-1} \text{ by } x^{2n-1} + y^{2n+1}$$

3*. Simplify—

$$\frac{x-a}{x - \frac{(x-b)(x-c)}{x+a}}$$

Solve the equation—

$$\sqrt{x} + \sqrt{x-16} = 8$$

GRAMMAR.

JUNE 13, 1874.

1. Name the three cases, and explain the different uses of each.
2. Define *gender*, *infinitive mood*, *etymology*, *transitive verb*.
3. Name the auxiliaries, and show in what way each one modifies the meaning of the verb.

4. Give the principal parts of the following verbs: *Ride, drown, lay, shake, slay, spread.*
5. Compare *least, more, near, shy.*
6. Decline *calf, hero, chimney.*
7. Give the plural of *court-martial, of man-servant, of focus.*
Give the feminine of *hero, hunter, executor.*
8. Parse: "As a matter of course, forgetting for the moment all his anxiety, he instantly started in pursuit."

GEOGRAPHY.

JUNE 13, 1874.

1. Name and describe the four chief rivers of France, telling where they rise, in what direction they flow, and into what water they empty.
2. Where is Singapore? Vera Cruz? Barcelona? Prague? Natal?
3. Fix the position of the following mountains, and state to what range each one belongs: (1) Mount Saint Elias, (2) Elburz, (3) Chimborazo, (4) Mount Washington.
4. Name in order the bodies of water through which you would pass in sailing from Bombay to Saint Petersburg.
5. Where is the Bay of Fundy? The Gulf of Guinea? The Sea of Azov? Lake Balash? Lake Pontchartrain?
6. What bodies of water are connected, and what bodies of land are separated, by the following: (1) Saint Clair River, (2) Rio de la Plata, (3) Dardanelles, (4) Straits of Mackinaw?
7. Fix the position of the following, and tell which, if any, are capitals of States, and of what States they are the capitals: (1) Saint Paul, (2) Saint Petersburg, (3) San Francisco, (4) Saint Louis, (5) Santiago.
8. Name the capital of each of the following States, and tell on what river it is situated: (1) Alabama, (2) Tennessee, (3) Kentucky, (4) Iowa, (5) Paraguay, (6) Hindoostan, (7) Italy.

ARITHMETIC.

JUNE 15, 1874.—Time allowed, five hours.

Questions 1st, 2nd, and 3rd are not required, but any one or all of them may be substituted for an equal number of the first ten questions.

1. Divide 27.18 by one hundred and fifty-one ten billionths, and write the result in words. Reduce $5\frac{1}{2}\frac{1}{10}\frac{1}{100}\frac{1}{1000}$ to a decimal. Find what decimal 3.3 feet is of a mile.

2. Subtract $\frac{1}{2}$ of $\frac{3\frac{1}{2}}{2}$ of $33\frac{1}{2}$ + $\frac{1}{2}$ of $\frac{4}{1+\frac{2}{15}}$ + $\frac{2}{3}$ of $\frac{1}{15}$ from 101 times the sum of $\frac{1}{2}$, and $\frac{1}{2}$ of $\frac{1}{15}$ of $\frac{1}{15}$.

3. Express $\frac{7\frac{1}{2} - 3\frac{1}{2}}{18\frac{1}{2} \text{ of } \frac{1}{4}}$ of £33 14s. 5½d. as a fraction of £157 17s. 8½d.

4. Find the number of acres in a piece of ground 1 fur. 20 rds. long, and 12 rds. 4 yds. 1 ft. 2.4 in. wide.

5. An elastic ball after striking the ground rises to $\frac{4}{5}$ of the height from which it falls. After striking the ground the third time it rises $3\frac{1}{2}$ inches. From what height did it fall at first?

6. Two boats row a race over a straight course 1 mile 995 yds. long, their rates of speed being 12 miles and $11\frac{2}{3}$ miles per hour respectively. Assuming that sound travels at the rate of 1140 feet per second, find how much the faster boat will be ahead of the other when the sound of the gun fired at starting is heard at the winning post.

7. A does $\frac{1}{3}$ of a piece of work in 4 hours, B does $\frac{1}{4}$ of what remains in 1 hour, and C finishes it in 20 minutes. How long would they have been doing the work if they had worked together?

8. A clock which was 1½ minutes fast at a quarter to 11 p. m. on June 10, was 8 minutes slow at 9 a. m. June 15. When was it exactly right?

9. A ditch is being dug at the rate of 81 feet per day by 54 men. After 13 days work 8 of them are replaced by boys, and the work goes on for 11 days more, at the end of which time the whole length dug is 1899 feet. What length of the ditch does each boy dig in a day?

10. Three men are employed in a work, working respectively 8, 9, and 10 hours a day, and receiving the same daily wages. After 3 days, each works an hour a day more, and the work is completed in 3 days more. If the total sum paid for the wages be \$22.81, how much should each receive?

1°. Write the factors of $a^3c - cd^3$, of $x^2 - 7x + 12$.

Multiply $x^{a-2b} + y^{2b-a}$ by $x^{2b-a} - y^{a-2b}$.

2°. Simplify the expression $\frac{\frac{x}{xy} + \frac{y}{x+y}}{\frac{x}{x-y} - \frac{y}{x+y}}$.

Multiply $2 + \sqrt{3}$ by $2 - \sqrt{3}$.

3°. Solve the equation $\frac{x-a}{a-b} - \frac{x+a}{a+b} = \frac{2ax}{a^2-b^2}$.

Find the value of $(64)^{-\frac{1}{2}}$, and $\{[16]^{\frac{1}{2}}\}^{-3}$.

GRAMMAR.

JUNE 16, 1874.

1. Decline (or inflect) *cargo, rally, wife*.
2. Compare *queenly, dry, gay, better*.
3. Give the principal parts of *abide, choose, let, lay, burst*.
4. What is an *irregular verb*? A *participle*? An *ordinal*? A *personal pronoun*?
5. What verbs have distinction of voice?
6. What classes of nouns are used in the singular only?
Give the plural of *bandit, court-martial, talisman, memorandum, echo*.
7. Decline all the personal pronouns in the singular.
8. Parse: "A daily increasing want of something better was felt by the public."

GEOGRAPHY.

JUNE 16, 1874.

1. Name five tributaries of the Mississippi River, telling where they rise, in what direction and through what States they flow, and into what water they empty.
2. Name, in order, the European states having any sea-coast, giving the capital of each, and the water on or near which it is situated.
3. Where is Melbourne? Hamburg? Batavia? Callao? Galveston? Monrovia?
4. Make a coasting voyage from Alexandria to Singapore; state what waters you pass through, and what countries you coast along, in order.
5. Give the position of the following, and state to what country each belongs: (1) Azores; (2) Vancouver's Island; (3) Channel Islands; (4) Ceylon; (5) Martinique; (6) Santa Cruz.
6. State in what country each of the following capes is situated, and into what water it projects: (1) St. Vincent; (2) San Roque; (3) San Blas; (4) Cape Clear.
7. Give the position and extent of the following ranges: (1) Cevennes; (2) Blue Ridge; (3) Jura; (4) Hindu-Koosh.
8. Fix the position of the six largest towns in the United States, and designate which, if any, are capitals of States.

REGULATIONS

GOVERNING THE

APPOINTMENT OF CADET-ENGINEERS IN THE NAVY.

I. In pursuance of the third and fourth sections of an act, passed at the first session of the Thirty-eighth Congress, approved July 4, 1864, "*To authorize the Secretary of the Navy to provide for the education of naval constructors and engineers, and for other purposes,*" and of the second section of an act, passed at the first session of the Thirty-ninth Congress, approved March 2, 1867, entitled "*An act to amend certain acts in relation to the Navy,*" applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate, or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. By an act, passed at the first session of the Forty-third Congress, approved June 22, 1874, the number of annual appointments of Cadet-Engineers is limited to twenty-five. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify, *on honor*, to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September, for examination as to their qualifications for admission.

IV. The course of study will comprise four academic years. The pay of a Cadet-Engineer is the same as that of a Cadet-Midshipman.

V. The academic examination previous to appointment will be competitive and will be on the following subjects, namely: Arithmetic; Algebra, through equations of the first degree; Plane Geometry; Rudimentary Natural Philosophy; Reading; Writing; Spelling; English grammar; English composition; and Geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those of Cadet-Midshipmen.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1874.

ARITHMETIC.

Time allowed, three hours.

1. Reduce $\frac{3}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}$ to a decimal. Reduce .001264 to a common fraction in its lowest terms. Divide .00041097 by 2163. Reduce $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}$ to a decimal. Divide 547723 by .000493.

2. Subtract $\frac{1}{2}$ of $\frac{3\frac{1}{2}}{\frac{1}{2}$ of $33\frac{1}{2}$ + $\frac{1}{2}$ of $\frac{\frac{1}{2}}{1 + \frac{1}{16}}$ + $\frac{\frac{1}{2}$ of $\frac{1}{16}$ from 101 times the sum of $\frac{1}{2}$, and $\frac{1}{2}$ of $\frac{1}{16}$ of $\frac{1}{16}$. Of the fractions $\frac{1}{16}$ of $2\frac{1}{2}$, $\frac{1}{16}$ of $3\frac{1}{2}$, and $\frac{1}{16}$ of $4\frac{1}{2}$; divide the sum of the greatest and least by the intermediate one.

3. Find the value to five places of decimals of $\sqrt[3]{.27} - \sqrt{.4}$.

4. If the weight of a cubic foot of water is 62.35 pounds avoirdupois, what is the error in calculating the weight of 1000 cubic feet on the supposition that a cubic fathom weighs 6 tons 1440 pounds?

5. If the price of candles $8\frac{1}{2}$ inches long be $37\frac{1}{2}$ cents per dozen, and that of candles of the same thickness and quality $10\frac{1}{2}$ inches long be 50 cents per dozen, which kind do you advise a person to buy? What would be the saving per cent. should your advice be followed?

6. A contractor employs a fixed number of men to complete a work. He may employ either of two kinds of workmen, the first at \$6.36 per week each, the second at \$4.44 per week each; the work of one of the former being to that of one of the latter as 5 to 4. If he finishes it as quickly as possible, he spends \$1296 more than he would have done if he had finished it as cheaply as possible, but takes 4 weeks less time. What would it have cost if he had employed equal numbers of the two kinds of workmen?

GEOMETRY.

Time allowed, one hour.

1. Define *angle*, *right angle*, *perpendicular*. What is the complement of an angle? The supplement? Prove that the three angles of any plane triangle are together equal to two right angles, and that either exterior angle is equal to the sum of the two opposite interior angles.

2. What is a *straight line*? A *plane surface*? Prove that if a straight line drawn parallel to the base of a triangle bisects one of the sides it bisects the other side also, and is equal in length to one-half the base.

3. State how triangles, quadrilaterals, and parallelograms are classified. Define each class, and illustrate by diagrams.

ALGEBRA.

Time allowed, three hours.

1. Separate each of the following quantities into its simplest factors:

$x^2 + 27x^2 + 2x - 3$, $2a^2 - \frac{1}{2}$, and $4a^2b^2 - (a^2 + b^2 - c^2)^2$. Show what is meant by a^{-m} , and by a^0 . Multiply $x^{a-b} + y^{b-a}$ by $x^{b-a} - y^{a-b}$.

2. Divide $x^5 - 8x^4 + 3x^3 - x + 18$ by $x^3 - x^2 - x - 1$, giving quotient and remainder.

Find the value of the fraction—

$\frac{x^2 - 7x + 12}{x^2 - 2x + 15}$ when $x = 0$, when $x = 3$, when $x = 4$, and when $x = 5$. What is the

value of $\frac{m(m-1)(m-2)}{m^3}$ when m is indefinitely great?

3. Simplify the expressions—

$$\left\{ \frac{\frac{1}{a} + \frac{1}{b+c}}{\frac{1}{a} - \frac{1}{b+c}} \right\} \left\{ 1 + \frac{b^2 + c^2 - a^2}{2bc} \right\}, \text{ and } \frac{3+2x}{2-x} - \frac{2-3x}{2+x} + \frac{16-x^2}{x^2-4}$$

4. Solve the equation—

$$12x - \frac{.18x - .05}{.5} = .4x + 9$$

Find x and y from the equations—

$$ax = by, \text{ and } x + y = c.$$

5. A's horse can trot a miles in b minutes; B's horse can trot c miles in d minutes. Find the greatest number of yards start that A can give B in a race of e miles.

GRAMMAR.

Time allowed, two hours.

1. Decline (or inflect) *chimney, commander-in-chief, cargo, wife*.
2. What is a transitive verb? A participle? An ordinal? A personal pronoun? An impersonal verb?
3. Give the principal parts of *abide, ring, strive, lay, lie, sit, set*.
4. Give the plural of *calf, hero, talisman, court-martial*.
5. Give the feminine of *hero, hunter, executor*. Name the relative pronouns, and state the classes of objects to which they may be applied.
6. How does the potential mood represent a fact? What tenses has this mood? Give the first person singular of the verb to *lay* in each of the tenses of this mood.
7. Compare *many, cleanly, little, elder, next*, without using adverbs.
8. Parse the words in italics in the following sentence: "*Even now there was some trouble; for I was put in* by the queen, and the *people* knew nothing of me, and *did all that lay* in their power to *keep me out*."

SPELLING.

Responsible.	Nuisance.	Relic.	Guerilla.
Ridicule.	Vengeance.	Linear.	Consequence.
Tragedy.	Sympathetic.	Melancholy.	Hopelessness.
Mechanic.	Covenant.	Artillery.	Recompense.
Cashier.	Felicity.	Extraordinary.	Shrewd.
Exaggerate.	Machinery.	Necessary.	Despicable.

GEOGRAPHY.

Time allowed, one hour.

1. Where is Melbourne? Stettin? Galveston? Monrovia? Singapore? Trieste?
2. Describe the following rivers, telling where they rise, in what direction they flow, and into what water they empty: (1) Loire, (2) Cumberland, (3) Niger, (4) Irrawaddy, (5) Vistula.
3. Bound Kansas.
4. Name the body of water on which each of the following cities is situated: (1) Charleston, (2) Genoa, (3) Lisbon, (4) Calcutta, (5) Montevideo. Tell which, if any, are capitals of States.

5. Name the peninsulas of Europe, and tell in each case the inclosing bodies of water.

6. Make a voyage from the head of Lake Superior to Pittsburgh.

7. Where is Mount Chimborazo? Mount Hecla? Cevennes Mountains? Blue Ridge? What is the great mountain-range of Mexico?

8. Where is Cape Mendocino? Cape Canaveral? Cape Bon? Cape Henlopen? Cape Gallinas?

Candidates will be required to write a short original letter, and an exercise in dictation.

RUDIMENTARY NATURAL PHILOSOPHY.

Time allowed, two hours.

1. Define *centre of gravity*; *mass of a body*; *moment of a force*; *relative rest*, and *relative motion*. If the velocity of a moving body increase uniformly, what can be inferred regard to the force acting upon it? What can be inferred if the velocity is uniform?

2. Define *specific gravity*. Can the pressure of a fluid on the bottom of a vessel containing it exceed the entire weight of the fluid? Give an explanation. How can the heat of steam be made to exceed 212° Fahrenheit?

3. A bottle, in the shape of a quadrangular pyramid, 3 inches square at the base and 10 inches in height, is filled with mercury, weighing 8 ounces per cubic inch; find the pressure on the bottom of the bottle.

4. At one end of a lever 20 inches in length, a weight of 4 pounds is placed, and is balanced by a weight at the other end; the sum of the weights, together with the pressure on the fulcrum, being 30 pounds, find the weight and its distance from the fulcrum.

5. A uniform cube floating in water sustains two weights of 8 pounds and 20 pounds, respectively, so placed as to keep one of its faces horizontal; the first being placed at a corner of the face, find the position of the other, the diagonal of the face being 10 inches.

6. Draw a diagram showing the construction of the common pump, and explain briefly the uses of the essential parts.

If a siphon be used for drawing off mercury, what is the greatest height at which the bend may be placed?

7. *Temperate* is marked on Fahrenheit's thermometer at 56° ; find the corresponding number of degrees on the centigrade thermometer.

8. If 9 cubic feet of a certain substance weigh 1000 pounds, find its specific gravity.

COURSE OF INSTRUCTION FOR CADET-MIDSHIPMEN.

DEPARTMENT OF SEAMANSHIP.

* **SEAMANSHIP.**—Description of all kinds of rope, and its practical manipulation for all purposes on shipboard; measuring for and fitting standing and running rigging; masting, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's SeamanSHIP, with lectures and illustrations from models.

SHIP-BUILDING.—The building, launching, and docking of ships; description and construction of docks; boat-building.

Text-book.—Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.—Organization, formations, and manœuvering of a fleet, under steam or sail.

Text-books.—Manual of Naval Tactics, (Ward); Steam Fleet Tactics, (Parker); United States Naval Signal-Book; Manual of Signals, (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP DRILLS.—Exercises on shipboard, with sails and spars.

NAVAL TACTICS.—Exercises in boats, under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal-Code.

Instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.—*Practical Naval Gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought-iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles in *vacuo* and in the atmosphere; initial, remaining, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles, and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.—Organization and formation of squad, company, and battalions; school of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet-exercise.

Text-book.—United States Infantry Tactics.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States steamer *Santee*.

MORTAR-PRACTICE.

FENCING.—Exercise with small swords and broadswords.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and solution of equations of the first and second degrees; reduction and transformation of surd quantities; proportions and progressions; summation of series; nature and construction of logarithms, and theory of equations.

GEOMETRY.—Plane and solid.

TRIGONOMETRY.—Analytical investigation of trigonometrical formulæ, and their application to the solution of all the cases of plane and spherical trigonometry; the construction and use of trigonometrical tables.

APPLICATION OF ALGEBRA AND TRIGONOMETRY.—Mensuration of planes and solids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the applications of this method, particularly to the projections of the sphere.

ANALYTICAL GEOMETRY.—Equations of the right line, plane and conic sections; discussion of general equations of the second degree, involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Johnson's Analytical Geometry; Bowditch's Useful Tables.

DEPARTMENT OF STEAM-ENGINEERY.

ENGINES.—The classification of marine steam-engines, with their varieties of arrangement. The study of details, and of the instruments and apparatus used in marine-service in connection with steam-engines. The varieties of valve-gear, of steam-generators, of propelling-instruments, condensers, distillers, and pumps. The principles followed to insure strength in construction.

PRACTICAL EXERCISES.—The management of engines and boilers in operation. The care, preservation, and adjustment of marine-engines. The use of fuel. The use of the indicator and the interpretation of indicator diagrams. Methods of computing the power and the evaporation, and of determining the incidental losses incurred at sea, which affect the power. The duties of the engine-room watch; the arrangement and disposition of the engineer force on shipboard.

Text-books.—Bourne's Catechism of the Steam-Engine; King's Practical Notes on the Steam-Engine.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—*Descriptive and physical astronomy.*—Description of the solar system; figure and magnitude of the earth, its motions and consequent changes of seasons; length of day and night; trade and periodical winds; nature and effect of parallax, refraction, dip of the horizon, precession, nutation, and aberration; theory of gravitation; Kepler's laws; explanation of the apparent motions of the sun, moon, planets, and comets, and the principles upon which the determination of their orbits depends; the moon's motions and phases; general theory of the tides; theory of eclipses; general description of the stars, and their distribution in space; measures of time; equation of time. *Practical astronomy.*—The use of astronomical instruments in determining the positions of celestial objects, and terrestrial latitudes and longitudes; optical principles involved in the construction of astronomical instruments, and in the theory of astronomical refraction. Calculation of eclipses and occultations.

NAVIGATION.—Sailing by compass; sailing on a great circle; various methods of finding a ship's place at sea; construction and use of charts, including topographical and hydrographic drawing; principles and use of the sextant and circle of reflection, and application of the glass prism to these instruments; the artificial horizon; the azimuth compass; methods of ascertaining the deviation of the compass, produced by

local attraction on shipboard; the log and other instruments for determining a ship's rate of sailing; sounding-instruments; nature and use of the Nautical Almanac; relations of time under different meridians; computation of altitudes and azimuths of celestial objects; finding, by means of amplitudes and azimuths, the variation of the compass; finding the latitude by meridian observations of the sun, moon, planets, and stars; by observations near the meridian, by single altitudes at a given time, and by two altitudes of the same or different objects; finding the longitude by the chronometer, by lunar distances, and by altitudes of the moon; Sumner's method of finding a line of position, and determining the ship's place by two such lines; rating a chronometer on shore by single altitudes, and by equal altitudes, and finding its error at sea by a series of lunar observations. Theory of the various problems of navigation and nautical astronomy, and the application of spherical trigonometry to their solution. Consideration of the true figure of the earth, and the corrections in nautical problems depending upon it.

SURVEYING.—Its principles and practice; measurement of heights and distances; leveling; trigonometrical surveying; hydrographical surveying; direct measurement of a base-line; measurement by sound; running lines of soundings; reduction for tides; survey of a harbor or river; fixing the position of shoals; running survey of a coast; geodetic corrections in extended surveys; application of astronomical observations for azimuth, latitude, and longitude.

Text-books.—C. J. White's *Astronomy*; Jeffers's *Marine Surveying*; Coffin's *Navigation*.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the Differential Calculus, including Taylor's theorem, and applications to problems of maxima and minima, and the tracing of curves; the Methods of Integration, and the application of the Integral Calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation, and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work, and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aeriform fluids*: laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

CHEMISTRY.—Qualitative analysis.

METEOROLOGY AND CLIMATOLOGY.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat, ancient and modern; sources of heat, conduction, radiation, and convection; specific heat; sensible and insensible caloric; effects of heat; instruments used for the measurement of heat; thermo-dynamics.

Text-books.—Rice and Johnson's Elements of the Differential Calculus, with Lectures ; Lectures on the Integral Calculus ; Todhunter's Mechanics for Beginners ; Wormell's Hydrostatics ; Ganot's Physics, (Atkinson's translation) ; Eliot and Storer's Manual of Chemistry ; Eliot and Storer's Chemical Analysis ; Deschanel's Natural Philosophy, Part IV.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States ; international law ; origin and growth of the science ; rights and duties of nations in peace and war ; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers ; extradition ; duties of ministers, consuls, and naval commanders ; confiscation of enemy's property and debts ; embargoes ; kinds of property liable to capture ; domicile ; privateering ; prizes ; *jus postliminii* ; rights and duties of neutrals ; law of contraband ; law of blockade ; right of search ; ship's papers ; truces, passports, and treaties of peace ; offenses against the law of nations ; piracy ; slave-trade.

Outlines of Maritime Law.

Lectures.

Text-book.—Kent's Commentaries, vol. 1.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations ; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1872 ; historical geography. Progress of colonial development in America ; history of the United States ; naval history ; lectures.

Text-books.—Freeman's Outlines of History, with Mitchell's Ancient Atlas and Johnston's Historical Atlas. Eliot's History of the United States, with Appleton's and Mitchell's Modern Atlases.

PHYSICAL GEOGRAPHY.—Ansted's Physical Geography, with Weller's Physical Atlas.

RHETORIC AND COMPOSITION.—Essential properties of style. Classification of sentences ; rules for the construction of sentences. Figures of Rhetoric. Exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH GRAMMAR.—Historical development of the English language ; relation of English to the other Aryan languages ; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation of English ; progress from the synthetic to the analytic forms of speech ; character and course of inflexional development. Grimm's law. Etymology ; inflexional changes since the Conquest. Syntax ; analysis of sentences.—Readings from classical authors, with applications of the principles of grammar, and exercises in analysis, and in tracing the etymological meaning of words.

ENGLISH LESSONS.—Classification of words ; definition of words by usage, and by derivation ; synonyms ; force of the common prefixes, affixes, and roots ; laws of change in the meaning of words, by contraction, extension, and amelioration.—Relation between spoken and written language ; faults in diction, and their remedies. Metaphor, as the basis of language. Selection and arrangement.—Elementary principles of reasoning ; the sources of knowledge and of error ; induction and deduction ; errors in reasoning ; fallacies.

Text-books.—Tancock's English Grammar and Reading Book. Seeley and Abbott's English Lessons. Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar ; exercises in reading, writing, and conversation.

Text-books.—Fasquelle's French Grammar ; Howard's Aid to French Composition ; Prud'homme's French Nautical Phrases ; Erckmann-Chatrian's Le Conscrit. Roget's Spanish Manual ; Tolon's Reader.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and c drawing.

The foregoing studies are distributed over four years, and the Cadet Midship are arranged in four classes, each class pursuing the course for the year.

PROGRAMME OF STUDIES FOR CADET-MIDSHIPMEN.

The time devoted to daily recitations is divided into three periods, designated thus: (1), (2) (1) denotes first period, from 8.30 a. m. to 10.30 a. m., except on Mondays, when it is from 9 a. 11 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m., except on Mondays, when it is 11 a. m. to 12.55 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m. Practical exercises 1 on Saturdays at 10.45 a. m., and on all other days, except Sundays, at 4 p. m.

First term: October 1, 1874, to February 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Seamanship.....	[Th.] (3).....	Practical Exercises.
Mathematics.....	[M. T. W. Th. F.] (2) [S.] (1).....	Algebra and Geometry.
English Studies, History, and Law.....	[M. T. W. Th. F.] (1) [T. F.] (3).....	Grammar, History and Composition.
Modern Languages.....	[M. W.] (3).....	Fasquelle's Grammar.
THIRD CLASS—SECOND YEAR.		
Seamanship.....	[T. F.] (2).....	Luce's Seamanship, and Practical Exercises.
Gunnery.....	[M. W.] (2).....	Ordnance Instructions.
Mathematics.....	[M. T. W. Th. F.] (1).....	Trigonometry and Spherical Projections.
English Studies, History, and Law.....	[Th.] (3).....	Descriptive Geometry.
Modern Languages.....	[M. W.] (3) [S.] (1).....	Physical Geography.
	[T. F.] (3) [Th.] (2).....	Fasquelle's Grammar, French Composition.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	[M. F.] (3) [W.] (1).....	Luce's Seamanship [M. and Ship-building [F.]
Gunnery.....	[F.] (2).....	Infantry Tactics.
Physics and Chemistry.....	[M. T. Th. F. S.] (1) [T. Th.] (3).....	Applied Mathematics [M. Th. F.] (1).
Modern Languages.....	[M. W.] (3) [Th.] (3).....	Magnetism and Electricity [Th.] (2) [S.] (1).
Drawing.....	[T. W.] (3).....	French Grammar, Le Carré and Sadler's Petit Carré Sketching.
FIRST CLASS—FOURTH YEAR.		
Gunnery.....	[M. T. W. Th.] (3).....	Ordnance and Naval Gun and Practical Exercises.
Steam-Engineering.....	[T. Th.] (2) [S.] (1).....	Marine Steam-Engineering Practical Exercises.
Astronomy, Navigation, and Surveying.....	[M. T. Th. F.] (1).....	Navigation and Nautical Astronomy.
Physics and Chemistry.....	[M. W. F.] (2).....	Practical Exercises.
Modern Languages.....	[W.] (1) [F.] (3).....	Optics and Acoustics. Spanish: Ollendorff's Method.

REGISTER OF THE UNITED STATES NAVAL ACADEMY. 65

Second term: February 1, 1875, to June 1, 1875.

Department.	Periods.	Subjects.
FIRST CLASS—FIRST YEAR.		
Ship	[M.] (3)	Practical Exercises.
Tactics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
Studies, History, and Law	[M. T. W. Th. F.] (1)	English Lessons, History and Composition.
Languages	[T. W. Th. F.] (3)	French Grammar and Exercises.
SECOND CLASS—SECOND YEAR.		
Ship	[T. F.] (2)	Luce's Seamanship, and Practical Exercises.
Tactics	[M. T. W. Th. F.] (1)	Analytical Geometry and Descriptive Geometry.
Science and Chemistry	[W. F.] (3)	Topography.
Studies, History, and Law	[M. W.] (3) [S.] (1)	Chemistry.
Languages	[T. Th.] (3)	Rhetoric and Composition.
	[M.] (3) [Th.] (2)	Fasquelle's Grammar and French Composition.
THIRD CLASS—THIRD YEAR.		
Ship	[W.] (1) [F.] (3)	Luce's Seamanship [W.] and Naval Tactics, (Ward and Parker,) [F.]
Science and Chemistry	[M. W.] (3)	Gunnery.
Studies, History, and Law	[M. T. Th. F.] (1)	Applied Mathematics and Mechanics.
Navigation, and Surveying	[M. W. Th.] (2)	Descriptive and Nautical Astronomy.
Languages	[T. F.] (2) [S.] (1)	Sadler, Nautical Phrase-Book and Grammar.
Sketching	[T. Th.] (3)	Sketching.
FOURTH CLASS—FOURTH YEAR.		
Ship	[W. Th.] (2) [T.] (3)	Luce's Seamanship, and Naval Construction.
Engineering	[M.] (2) [W. S.] (1)	King's Marine Steam-Engine, and Practical Exercises.
Navigation, and Surveying	[M. T. Th. F.] (1)	Nautical Astronomy, and Surveying; Practical Exercises.
Science and Chemistry	[T. F.] (2)	Heat and Climatology.
Studies, History, and Law	[W. F.] (3)	Constitution of the United States, and International Law.
Languages	[M. Th.] (3)	Spanish: Ollendorff's Method.

COURSE OF INSTRUCTION FOR CADET-ENGINEERS.

First Class of 1874-75.

Differential Calculus; Integral Calculus; Mechanics; Hydrostatics; Descriptive Geometry; Analytical Chemistry; Heat; Electricity and Electrical Measurements; Steam-Engineering (practical and theoretical); Mechanical Drawing. The course of instruction for Cadet-Engineers during the first year will be the same as the Fourth Class of Cadet-Midshipmen, except the substitution of exercises in Steam-Engineering for those of the Cadet-Midshipmen in Seamanship, Great Guns, and Howitzers.

Text-books.—Bourne's Hand-Book of the Steam-Engine; Warren's Elements of Mechanical Drawing; Rankine's Steam-Engine and other Prime Movers; Jenkins's Electricity and Magnetism; Eliot and Storer's Qualitative Chemical Analysis. The text-books used by the Cadet-Engineers are the same as those used by the Cadet-Midshipmen.

PROGRAMME OF STUDIES FOR CADET-ENGINEERS.

The time devoted to daily recitations is divided into three periods, indicated thus: (1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m., except on Mondays, when it is from 9 a. m. to 10.30 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m., except on Mondays, when it is from 11.15 a. m. to 12.45 p. m.

66 REGISTER OF THE UNITED STATES NAVAL ACADEMY.

11 a. m. to 12.55 p. m.; (3) denotes third period, from 2 p. m. to 4 p. m. The daily practical exercises of Cadet-Engineers are the same as those of Cadet-Midshipmen, except the substitution of practical exercises in Steam-Engineering for practical exercises in Seamanship, Great Guns, and Boat-Howitzers.

First term: October 1, 1874, to February 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS.		
Steam-Enginery	[Th.] (3)	Practical Exercises.
Mathematics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	[M. T. W. Th. F.] (1) [T. F.] (3)	Grammar, History and Composition.
Modern Languages	[M.] (3) [W.] (3)	Faquelie's Grammar.
SECOND CLASS.		
Mathematics	[M. T. W. Th. F.] (1)	Algebra and Trigonometry.
Modern Languages	[T. F.] (2)	French Grammar.
Steam-Enginery	[T. F.] (3) [W. Th.] (2)	Mechanical Drawing.
	[M.] (2) [Th.] (3)	Steam-Engineering.
	[M. W.] (3) [S.] (1)	Practical Instruction.
FIRST CLASS.		
Physics and Chemistry	[M. T. Th. F.] (1)	Applied Mathematics.
	[M. W.] (2) [Th.] (3)	Heat.
Modern Languages	[W. S.] (1) [Th.] (2)	Chemistry.
	[T. F.] (2)	Faquelie's French Grammar.
Steam-Enginery	[M. T. W. F.] (3)	Designing and Drawing Machinery, and Practical Instruction.

Second term: February 1, 1875, to June 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS.		
Steam-Enginery	[M.] (3)	Practical Exercises.
Mathematics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	[M. T. W. Th. F.] (1)	English Lessons, History, and Composition.
Modern Languages	[T. W. Th. F.] (3)	French Grammar and Exercises.
SECOND CLASS.		
Mathematics	[M. T. W. Th. F.] (1)	Analytical Geometry and Descriptive Geometry.
Modern Languages	[M. W.] (2)	Faquelie's French Grammar.
Steam-Enginery	[M. T. W. Th. F.] (3)	Mechanical Drawing.
	[T. Th. F.] (2) [S.] (1)	Engineering, and Practical Instruction.
FIRST CLASS.		
Physics and Chemistry	[M. T. Th. F.] (1)	Applied Mathematics and Mechanics.
	[W.] (1) [T. Th.] (2)	Magnetism and Electricity.
Modern Languages	[T. Th.] (3)	Chemistry.
	[M. W.] (2)	Faquelie's French Grammar.
Steam-Enginery	[M. W. F.] (3) [F.] (2) [S.] (1)	Drawing and Designing Machinery, Steam-Engineering, (Bourne and Rankine), and Practical Instruction.

EXAMINATION-PAPERS--1873-74.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

MONTHLY EXAMINATION.

OCTOBER, 1873.—*Time allowed, two and a half hours.*

Resolve each of the following expressions into its simplest factors : $a^2c - cd^2$, $a^3 + 2x^2 + x^4$, $x^2 - 7x + 12$, $x^4 - 25x^2 + 144$, and $x^3 - 2x^2 - 5x + 6$. Prove that is divisible by $a - b$.

Divide $x^6 - 2x^5 + 3x^3 + x^2 - 17$ by $x^2 - 2x - 1$. Multiply—

$$(x^{a-2b} + y^{2b-a}) \text{ by } (x^{2b-a} - y^{a-2b})$$

Reduce the result to its simplest form. Find the value of the fraction—

$$\frac{x^2 - 3x + 2}{x^2 - 4x + 3}$$

when $x = 0$, when $x = 1$, when $x = 2$, and when $x = 3$.

Reduce the expression—

$$\frac{\frac{x}{xy} + \frac{y}{x+y}}{\frac{x}{x-y} - \frac{y}{x+y}}$$

Reduce to its simplest form. Find the value of—

$$\left\{ \frac{x+2a}{2b-x} + \frac{x-2a}{2b+x} + \frac{4ab}{x^2-4b^2} \right\}$$

$$\text{when } x = \frac{ab}{a+b}$$

Find the value of x in the equation—

$$\frac{x-a}{a-b} - \frac{x+a}{a+b} = \frac{2ax}{a^2-b^2}$$

Find y from the equations—

$$ax + by = c,$$

$$bx + ay = d.$$

There are two places, a miles distant from each other, from which two persons, A and B, start out to meet on the road. A travels b miles in c hours, and B travels d miles in e hours. How long and how far must each travel before they meet?

MONTHLY EXAMINATION.

NOVEMBER 29, 1873.—*Time allowed, two and a half hours.*

Find the 9th term of $(x+y)^{17}$. Write the square of $(a+b+c-d)$. Develop—

$$\frac{1}{(a^2-x^2)}^{-\frac{1}{2}}$$

Expand in terms by the binomial formula. Develop—

$$\left[1 + \frac{1}{x} \right]^x$$

Expand in terms; find the value of this expression when x is infinite.

2. Extract the square root of 1711.059 to two decimal places. Extract the square root of 0.0003715 to four decimal places. Extract the cube root of 37.001285 to four decimal places. A whole number consists of $5n - 1$ figures; how many figures are in its n th root, supposing the number to be a perfect n th power? Supposing the figure of the root in this case to be 1, what will be the trial-divisor for obtaining the second figure?

3. Find the numerical value of each of the following expressions—

$$(16)^{\frac{1}{2}}, \quad \sqrt{16}, \quad (64)^{-\frac{1}{2}}, \quad \frac{1}{\sqrt[3]{(32)^{-\frac{1}{2}}}}, \quad \text{and} \quad \left\{ (16)^{\frac{1}{2}} \right\}^{-3}.$$

Divide—

$$2x^{\frac{1}{2}}y^{-\frac{1}{2}} - 5x^{\frac{1}{2}}y^{-\frac{1}{2}} + 7x^{\frac{1}{2}}y^{-\frac{1}{2}} - 5x^{\frac{1}{2}}y^{\frac{1}{2}} + 2x^{\frac{1}{2}}y^{\frac{1}{2}} \text{ by } x^{\frac{1}{2}}y^{-\frac{1}{2}} - x^{\frac{1}{2}}y^{-\frac{1}{2}} + x$$

Extract the square root of— $\left[x + \frac{1}{x} \right]^2 - 4 \left[x - \frac{1}{x} \right]$

How may the fraction—

$$\frac{1}{\sqrt{a} + \sqrt{b}}$$

be reduced to an equivalent form in which the denominator is rational?

4. Find the numerical value to six decimal places of the expression—

$$\frac{3 - \sqrt{5}}{3 + \sqrt{5}}, \quad \text{given } \sqrt{5} = 2.236068$$

Reduce the expression—

$$\frac{(2 + \sqrt{3})(5 + \sqrt{5})(3 + \sqrt{3})}{(2 - \sqrt{3})(\sqrt{5} + 1)(\sqrt{3} + 1)}$$

to its simplest form.

5. Solve the equations—

$$a\sqrt{b-x} = b\sqrt{a-x},$$

$$\frac{\sqrt{x+a} + \sqrt{x}}{\sqrt{x+a} - \sqrt{x}} = a.$$

$$ax^2 + cx = d.$$

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—Time allowed, five hours.

1. Separate each of the following expressions into its simplest real factors:

$$a^4x^4 - b^4y^4, \quad x^3 + y^3, \quad x^3 - y^3, \quad x^2 - 19x + 88, \quad 4x^2 - 34x + 72, \quad 3a^2 + 4ab - \{4(ad - bc)^2 - (a^2 - b^2 - c^2 + d^2)^2\}, \quad x^2 + 1, \quad x^4 + 2x^2 + 9.$$

2. Show that $a^0 = 1$, and explain the meaning of a^{-m} . What is the greatest common divisor of two or more quantities? The least common multiple? Find the least common divisor of $x^4 + 24x + 55$ and $11x^4 + 24x^3 + 125$.

3. Add $\frac{3x-a}{5x+3a}$ to $\frac{x+3a}{7x+9a}$

Take $\frac{a-x}{2a^2+3ax+x^2}$ from $\frac{2a+x}{a^2-x^2}$

Find the value of the fraction—

$$\frac{x^2 + 3x - 28}{x^2 + 2x - 24}$$

when $x = 4$. What limiting value does this fraction approach as x becomes infinitely great?

olve the equation—

$$\frac{x-a}{b} + \frac{x-b}{c} + \frac{x-c}{a} = \frac{x-(a+b+c)}{abc}$$

from the equations $ax + by = c$, $bx = d + ay$, and $x + y + z = a$.

Extract the square root of 0.00036 to 5 decimal places. Extract the cube root of 0.196 to 3 decimal places. Find y from the equation

$$y^3 = 8a^3 - 36a^2c + 102a^2c^2 - 171a^2c^3 + 204a^2c^4 - 144ac^5 + 64c^6.$$

What is meant by the degree of an equation? When is an equation said to be homogeneous? What is an indeterminate equation? What is an identical equation? Is a root of an equation? Prove that an equation of the second degree has two and only two, and show to what quantities the sum and the product of these roots are equal.

Write five terms of the development of $(a \pm b)^m$. Write the development of $(x^2 + 1)^5$. Develop $(a - 2c)^{\frac{1}{2}}$ to four terms. Develop—

$$\frac{x}{\sqrt[3]{a^3 - x^3}}$$

in terms.

Multiply together $(x^2 + 1)$, $(x^2 + x\sqrt{3} + 1)$, and $(x^2 - x\sqrt{3} + 1)$. Find the numerical value of—

$$\frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$$

to decimal places. Simplify the expression—

$$\frac{3 + 4\sqrt{3}}{\sqrt{6} + \sqrt{2} + \sqrt{5}}$$

olve the equations—

$$\frac{x+2}{x-1} - \frac{4-x}{2x} = \frac{7}{3}$$

$$x^4 - 14x^2 + 40 = 0$$

$$(7 - 4\sqrt{3})x^2 + (2 - \sqrt{3})x = 2$$

Find x and y from the equations, $x^2 + y^2 = \frac{1}{2}xy$ and $x - y = \frac{1}{2}xy$.

Two travelers, A and B, set out at the same time from two places, P and Q, respectively and travel so as to meet. When they meet it is found that A has traveled a miles more than B, and that A will reach Q in b hours and B will reach P in c hours after they meet. Find the distance between P and Q.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, five hours; answers to ten questions required.

Simplify—

$$\frac{1}{(a-b)(a-c)} + \frac{1}{(b-a)(b-c)} + \frac{1}{(c-a)(c-b)}$$

$$\text{and} \quad \frac{x^p + q}{x^q} \div \frac{q}{x^{q-p}}$$

Find the value of the expression

$$\frac{x^2 + xy + y^2}{x^2 - xy + y^2}$$

$$\text{when} \quad x = \frac{2 + \sqrt{3}}{2 - \sqrt{3}}, \text{ and } y = \frac{2 - \sqrt{3}}{2 + \sqrt{3}}$$

2. Solve the equations—

$$(x + a)(x + a + b) = (x + b)(x + 3a)$$

and—

$$\begin{cases} x^2 + mx = ny^2 \\ \frac{x}{a} + \frac{y}{b} = 1 \end{cases}$$

3 Solve the equations—

$$\sqrt{2x-1} + \sqrt{3x+10} = \sqrt{11x+9}$$

and—

$$\begin{cases} x + y = a\sqrt{xy} \\ x - y = c\sqrt{\frac{x}{y}} \end{cases}$$

4. Form the equation whose roots are $1 \pm \sqrt{-2}$, and $2 \pm \sqrt{-3}$, and find the equation whose roots are greater by unity than those of the resulting equation. Solve the equation—

$$x^3 - 18x^2 + 157x - 510 = 0$$

by first removing the second term. Transform the equation—

$$x^3 + 5x^2 + 8x - 1 = 0$$

to another wanting the third term. Divide—

$$x^6 + 11x^4 + 13x^2 + 15x + 17 \text{ by } x^3 - x^2 - x - 1$$

by synthetic division.

5. Prove that the sum of any $(2n + 1)$ consecutive integers is divisible by $(2n + 1)$. In an arithmetical progression, given d , l , and s , find a . In a geometrical progression, given a , l , and s , find r .

6. Two trains, a feet and b feet in length, respectively, move on parallel rails with uniform velocities. When they move in opposite directions, they are observed to pass each other in c seconds; but when they move in the same direction, the faster is observed to pass the other in d seconds. Find the rate at which each train moves.

7. Separate each of the following fractions into partial fractions—

$$\frac{x^2 + 3}{x(x-1)(x-2)(x-3)}, \quad \frac{x^2 + 3}{(x+1)(x-1)^2}, \quad \text{and} \quad \frac{x^2 + 3}{x^6 - 1}$$

Write the development that should be assumed in order to separate—

$$\frac{1}{x(x-1)^2(x^2+1)(x^2-x+1)^2}$$

into partial fractions.

8. Find K from the formulas—

$$K = \frac{\sqrt{s(s-a)(s-b)(s-c)(s-d)}}{s = \frac{1}{2}(a+b+c+d)}$$

Given—

$$\begin{array}{ll} a = 6.3246, & c = 8.5441, \\ b = 7.7459, & d = 5.1961. \end{array}$$

9. Find the modulus of the system of logarithms whose base is 7. Find x if the equation—

$$\left[\frac{-}{c} \right]^{\frac{a}{x}} = d^x$$

Given—

$$\begin{array}{ll} a = 0.0057643, & c = 1.0433, \\ b = 4.5763, & d = 10.024. \end{array}$$

10. Solve the equation—

$$x^3 - 1536.09 = 0$$

by Horner's method, obtaining the root to three places of decimals. Solve the following equations, which have a root in common—

$$\begin{array}{l} x^3 - 3x^2 - 16x - 12 = 0, \\ x^3 - 7x^2 + 5x + 13 = 0. \end{array}$$

11. Deduce Cardan's rule for the solution of cubic equations, and apply it to solve the equation—

$$x^3 - 9x^2 + 28x - 34 = 0.$$

GEOMETRY.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, five hours ; answers to ten questions required.

1. What is meant by a *medial line*? What is the difference between a trapezium and a trapezoid? What is a spherical triangle? A polar triangle? A tri-rectangular triangle? Define *cylindrical surface*. What is the significance and numerical value of π ? The area of a circle being denoted by c^2 , find its radius and circumference.

2. Prove that the three perpendiculars erected at the middle points of the sides of a triangle meet in a point. Prove that the chord of an arc of 60° is equal to the radius.

3. Prove that the area of a regular dodecagon is equal to three times the square described on the radius of the circumscribed circle. Denoting this radius by a , find an expression for the length of the perimeter of the dodecagon.

4. Prove that the sum of all the face-angles of any convex polyhedral angle is less than four right angles. State and prove the theorem from which is derived the formula for the volume of a triangular pyramid.

5. Find the area in square miles of a polygon formed by arcs of great circles on the surface of the earth, the angles of the polygon being $137^\circ 30'$, $213^\circ 14' 30''$, $29^\circ 43' 30''$, $111^\circ 30'$, $50^\circ 30'$, and the radius of the earth 4,000 miles.

6. A rectangle $ABCD$ has its side BC double the side CD . A diagonal is drawn and a circle described on AD as a diameter. The whole figure is then revolved about AD as an axis. It is required to determine (1) the relation between the volumes of the three solids so generated—cone, cylinder, and sphere; and (2) the relation between the surfaces of these solids.

7. What must be the diameter of the bore of a gun to throw a shot similar to that thrown by a XV-inch gun and of double its weight? Find the weight of the XV-inch spherical shot, supposing a cubic foot of iron to weigh 450 pounds.

8. A cylindrical beam is 30 feet in length and 2 feet in diameter. Find the volume, in cubic feet, of the greatest rectangular beam that can be cut from it, having its adjacent sides in the ratio of 2 : 3.

9. A rectangular parallelepiped and an oblique prism stand upon a horizontal plane. The base of the prism is an equilateral triangle, and its edges are parallel to one of the diagonals of the parallelepiped. It is required to find the volume of the prism and the area of its right section, having given the sides of the base of the parallelepiped a and b , and its altitude h , the side of the prism c , and edge d .

10. An element of a right circular cone makes an angle of 60° with the plane of its base. What must be the altitude of the cone in order that its volume may be equal to that of a sphere 10 inches in diameter? Compare the surfaces of the cone and sphere.

11. An isosceles triangle, having its base equal to $2a$ and its altitude to a , has inscribed within it a rectangle, one of whose sides is a . In the portion of the triangle between the vertex and the rectangle a similar rectangle is inscribed, and so on *ad infinitum*. Find the sum of the areas of all the rectangles.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

OUTLINES OF HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY 29, 1874.—Time allowed, five hours.

A number marked with an asterisk (*) may be substituted for the same number without it, but for no other.

1. Place, geographically and ethnologically,—1. Basque. 2. Breton. 3. Magyar. 4.

Angles [before 450 A. D.]. 5. Czech. 6. Bulgarian [950 A. D.]. 7. Carthaginian. 8. Danes in England [before 1013].

2. (a) Athens, (1) after the Persian wars, (2) after the Peloponnesian war.

(b) "The geographical nature of the land settled the history of the Greek people." Explain.

(c) 133 B. C. Three events.

(d) Show the connection between Augustus, Charles the Great, and Francis II., King of Germany. All Roman emperors: how?

2.* (a) Achaian League.

(b) Explain the terms *Tyrant* [ancient Greece], *Emperor*, *Caliph*, *Exarch*, *Patrician* [early commonwealth], *Patrician* [Pippin]. (Take last two and any two of the first four.)

(c) How did Augustus get absolute power?

(d) "Christianity took different shapes in different parts of the Roman empire." Apply this to the three geographical divisions under Constantine.

3. (a) Frankish empire of Charles the Great; French empire of Bonaparte [1812]. Compare: as to (1) nationality, (2) imperial rights, (3) geographical limits.

(b) 710, 732, 1453, 1492, 1571. Connect.

3.* (a) Lotharingia; boundary of kingdom [843]; modern name, (1) French, (2) German. Extent of modern province.

(b) Laon and Paris [887-987]. Compare (*full answer*).

4. (a) What was the mediæval theory of the Church and the Empire? What prevented this theory from being carried out?

(b) How did the feudal system affect forms of government?

(c) Show the workings of the system in France.

(d) State the claims of Anjou and Aragon to the throne of Naples.

5. (a) Name the first four Angevin kings of England, and tell how the family came to the throne.

(b) Peace of Breigny; treaty of Troyes. Dates and provisions of each.

(c) What did England keep at the end of the 100-years' War?

5.* (a) 1215, 1265: connect. Explain in full the constitutional change accomplished at the second date. By whom was it brought about?

(b) How far did ecclesiastical reform go under Henry VIII.?

(c) Show the claims of George I. to the throne of England. (Make a table.)

6. (a) Name the three cantons which began the Swiss league. What were the relations of the league with the dukes of Austria? How were these relations settled at Morgarten and Sempach?

(b) Name the Emperors from Rudolf I. to Frederick III., showing to what line each one belongs.

6.* (a) State the political and geographical changes in the Netherlands since 1609.

(b) War of the Spanish Succession; war of the Polish Election; war of the Austrian Succession. Points at issue and results in each case.

7. In the period 1713-1789, "a new German power came to the front in Germany, and it has gradually grown to be the head of Germany, much in the same way as *Wessex* grew in England, Castile in Spain, and France in Gaul. But its rise did not, like the rise of Russia, bring a race and religion from the background to the front." Explain in full all the allusions.

8. (a) How did Bonaparte provide thrones for the different members of his family?

(b) Four revolutions: 1789, 1830, 1848, 1851. State the causes and character of each.

(c) Give dates and results of each of the three wars in which France has been engaged since the last of these revolutions.

9. (1) Salamis, (2) Constance, (3) Leipsic, (4) Plassey, (5) Clermont, (6) Novara, (7) Tilsit, (8) Belgrade, (9) Gothland, (10) Metz. Give geographical position, and point of historical importance. (Take six.)

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1874.—*Time allowed, five hours.*

I.

1. Give the subdivisions of the family of languages to which English belongs, and state the languages comprised in each group.
2. What are the tests of kinship in related languages?
3. Explain the terms British, Saxon, English, as applied in the VI. century. Comment on the term Anglo-Saxon.
4. Show why inflexions are lost in the development of a language.

II.

1. "Close likeness to Scandinavian dialects is to be found in Northern English; close likeness to Frisian dialects in Southern English." Why?
2. In what four ways did Latin exert an influence over the English language?
3. How and when did the Provençal influence English?
4. What were the four dialects of the *langue d'Oïl*?

III.

1. "The Northmen, who became Frenchmen in France, became Englishmen in England." Explain and illustrate.
2. Why is English rich in synonyms? Give examples.
3. What was the character of the words introduced by the Norman-French? How did they come to be introduced?

IV.

1. Define *auxiliary verb, syntax, adjective, root, inflexion, absolute superlative.*
2. Inflect the noun *eye* [eye], giving forms of the XI. century, of the XIV. century, and of modern English.
3. Give the distinguishing marks of the four declensions. Which of them is most common? Why?

V.

1. Explain the formation and etymological force of *nearer, lady, gentle.*
2. Illustrate the gradual loss of inflexions in English by the case of the adjective *gōda* [good]. (O. E. inflexions in full.)
3. Discuss the theory that the possessive case of nouns is formed by the elision of the possessive pronoun *his*.
4. Compare *old, tidy, shy.*

VI.

1. Give all the inflected tense-forms of the verb *to love* [*lufian*], in the indicative mood, in the three stages of English inflexion.
2. Give the three successive forms of the past participle of the same verb.
3. Explain the formation of any four of the following: *Outlaw, grapple, hillock, glad-some, mankind, sweeten, liquefy, rookery.*
4. Give the history of the terminations in the following: *Dorchester, songstress, riches, only, known, lent.*

VII.

"*Though justice be thy plea, consider this,
That in the course of justice, none of us
Should see salvation; we do pray for mercy,
And that same prayer doth teach us all to render
The deeds of mercy. I have spoke thus much
To mitigate the justice of thy plea;
Which, if thou follow, this strict court of Venice
Must needs give sentence 'gainst the merchant here.*"

Explain etymologically and syntactically the words in italics.

VIII.

"Strike, as thou didst at Cæsar; for I know
When thou didst hate him worst, thou lovedst him better,
Than ever thou lovedst Cassius."

Analyze.

IX.

"Now of my own accord such other trial
I mean to show *you* of my strength : yet *greater*,
As with *amaze shall strike* all who behold."

Explain the construction of the words in italics.

X.

Give the principal parts of all the verbs in the above extracts, designating the conjugation (weak or strong) to which each belongs, and explaining peculiarities of formation.

ENGLISH LESSONS.

ANNUAL EXAMINATION.

MAY 23, 1874.—*Time allowed, five hours.*

I.

1. How is the meaning of a word ascertained by induction ?
2. How is it ascertained by deduction ?
3. Show, with instances, the danger of trusting entirely for the meaning of a word to a knowledge of its roots.
4. What are synonyms ?
5. Take as illustrations any three synonymous words, and show by the method of elimination the difference in meaning.

II.

1. "To increase one's vocabulary does not always imply increasing the number of one's notions." Show this.
2. Explain generalizing.
3. What are *hybrids*, and what rule for the formation of words do they violate ?
4. State Grimm's law, and account for its existence.
5. Name the six laws of linguistic change, and give an illustration of each, showing from the etymology of the word how the law applies.

III.

1. Show that impassioned prose may approximate to the (a) metre, (b) brevity, or poetry. In what point does the best prose of this kind keep itself distinct from poetry ?
2. When are poetic quotations and periphrases admissible, and when not ?
3. What is the fault of *fine writing*, and how is it to be avoided ?
4. Distinguish between a long enumerative sentence and a long complicated sentence.
5. What is a heterogeneous sentence ? Wherein consists the difficulty of understanding it ?

IV.

1. What is an antithetical style ? What are its advantages ?
2. Explain the three forms of personification.
3. Show that implied metaphor is the basis of a great part of language.
4. Explain hyperbole.
5. Give the laws regulating the formation and employment of metaphors.

V.

1. What is the aim of scientific composition ?
2. How is uniformity of arrangement carried out in the different kinds of scientific writing ?
3. What considerations are excluded from didactic composition, and why are they excluded ?

4. What are the characteristics of imaginative literature ?
5. Name and classify the different kinds of incidents which are said to be interesting, in themselves or indirectly.

VI.

1. Explain the sources of knowledge, and the corresponding sources of error.
2. What is meant by induction through enumeration ?
3. Why is experiment necessary to induction ?
4. Show how experiment can prevent the error *post hoc, ergo propter hoc*.
5. Explain the character and force of the argument from analogy, in predicting the recurrence of natural phenomena.

VII.

1. Explain the terms *proposition, middle term, syllogism, distribution, ignoratio elenchi, begging the question*.
2. What are *universal propositions* ? *Propositions of identity* ?
3. Explain the process of *definition* as compared with *description*. What are provisional definitions ?
4. Explain the difference between *essentials* and *accidents*.
5. What is meant by *mathematical certainty* ?

VIII.

1. Speaking of Rome in the time of the empire, Merivale says, "The shadowy phantom of the Republic continued to flit before the eyes of Cæsar. There was still, he apprehended, a germ of sentiment existing, on which a scion of his own house, or even a stranger, might boldly throw himself, and raise the standard of Patrician independence." Criticise this.
2. "The wine of life is drawn ; and the mere lees
Is left this vault to *brag* of."
Expand ; point out the fault in *brag*.
3. "They would free us from the yoke of error." Expand.
4. A raging storm. A cruel disaster. A dying lamp. The force of sympathy. I see the point. A rigid system of trade. It is high time.
Show how analogy has given rise to these expressions.

IX.

1. "Hunger, gaunt and famine-eyed." Explain the figure.
2. "Where we are,
There's daggers in men's smiles ; the near in blood,
The nearer bloody." Explain.
3. "Some schooners have three masts ; ocean-steamers are not schooners." Conclusion ? Draw diagram and explain.
4. "All cyclones are dangerous to ships ; some storms are cyclones." Conclusion ? Draw diagram and explain.

X.

1. "Everything which obstructs the free course of justice deserves the reprobation of the virtuous. There are modes of enforcing the letter of the law which obstruct the strict course of justice." Conclusion ? Draw diagram.
2. Convert the following propositions : "All horses are animals." "All men are endowed with reason." "No honest men are unjust." "No frigate is an iron-clad." "General Grant is President of the United States." State the character of each proposition.
3. A member of Parliament advocated the passage of a certain bill under discussion. He was followed by a member of the opposition, who proved conclusively that the last measures brought forward by the government had been attended with disastrous re-

sults. In consequence of his speech, several members changed their minds, and voted against the bill. Discuss the cause of their change.

4. A and B arguing at an election :

A. You ought to be ready to follow Gladstone's leadership.

B. Why ?

A. Because his ideas of reform are the correct ones.

B. But how do I know that they are correct ?

A. You surely cannot doubt their correctness, when they have such a high authority as Gladstone.

Criticise the reasoning.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN-QUESTIONS.

Translate into French :

Who has silk velvet ?

The hatter has silk velvet and a silk hat.

Has your brother that lady's umbrella ?

Are you more attentive than your sister's husband ?

I am not so attentive to ladies as he is.

Has your gardener many good vegetables this year ?

Yes, sir, he has ; but not so many as last year.

What day of the month is to-day ?

I believe it is the sixth.

How old is your brother-in-law ?

He is fifty years old.

Does your companion like reading ?

My companion does not like reading.

What is the Irishman going to do ?

He is going to teach music.

Will you send my letter to him to-morrow ?

I will send it to you to read first.

Does your family-physician understand French ?

He knows French, English, and German very well.

Have you what you want ?

We have not always what we want or wish.

Whose hat is that in your room ?

Conjugate all moods and tenses of the verbs avoir and être.

ORAL EXAMINATION.

Name the different accents employed in French.

Give the French alphabet.

Are final consonants pronounced in French ?

What do you understand by *h*, mute or aspirate ?

How many articles are there in French ?

What occurs when the article precedes a word beginning with a vowel ? With *h* mute ?

How many genders are there ?

- Is there any rule for distinguishing gender?
 Give the rules governing the contraction of the article.
 Which is put first in French, the possessor or the object possessed?
 Explain what is meant by "a partitive sense."
 How are sentences made negative?
 Give all the idioms formed with *avoir*.
 If a noun is taken in a partitive or a general sense, what commonly precedes it?
 Name the demonstrative pronouns, and tell what positions they occupy.
 Supposing that any difference exists between *this* and *that*, how is the difference expressed in French?
 How is the plural of nouns formed?
 Do adjectives follow the same rule?
 How many conjugations are there? Give the terminations of each.
 Explain the use of *en*.
 Give the cardinal numbers from 10 to 65.
 Which is correct, *le onze*, or *l'onze*?
 Conjugate the verbs *faire*, *aller*, and *dire*.
 Conversation in simple phrases.

THIRD CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, MAY, 1874.

I.

1. Describe hawser-laid rope.
2. Make a log line. State how the length of a knot is ascertained.
3. Fit No. 1 pair of lower shrouds.
4. Reeve and set up flying-jib and royal stays.
5. Reeve a crossjack brace.
6. Sheet-anchor in scow alongside; stow it.
7. Ship heads ENE. † E. on port tack; how will she head on starboard tack?

II.

1. Describe the manner of straight-pointing a rope.
2. Describe a gun-tackle purchase; state its use and the power gained.
3. State in what order the rigging goes over the fore-topmast-head.
4. Rig purchase, and get over whole tops.
5. Reeve main bowline.
6. Stow a jib.
7. Ship heads NW. by W. † W. on starboard tack; how will she head on port tack?

III.

1. Describe shroud-laid rope. State its use.
2. Describe a log-line and time-glasses.
3. Fit mast-head pendants.
4. Send aloft and cross a topsail-yard.
5. Reeve a fore-topsail brace.
6. Transport a sheet-anchor from waist to bow.
7. Ship heads N. † E. on the port tack; how will she head on the starboard tack?

IV.

1. How is wire rope made ?
2. Describe a ground-log. State its use.
3. Measure for each pair of lower shrouds, in their order.
4. Send aloft and rig a topmast-studding-sail-boom.
5. Reeve a fore-brace.
6. Describe yard-tackles, triatic-stay, mast-head pendant, tackles, and a winding-purchase. State how they are applied.
7. Ship heads NE. by E. $\frac{1}{4}$ E. on port tack ; how will she head on the starboard-tack ?

V.

1. How are Spanish-foxes made ? State their use.
2. Fit a single Spanish-burton. State the power gained.
3. Measure for and fit mizzen-royal stay.
4. Rig whips, send aloft and place lower stays, and reeve laniards.
5. Reeve spanker-sheets.
6. Name and describe the different parts of an anchor.
7. Ship is running 4 points free, on port tack, wind NNE. ; how does she head ?

VI.

1. How is a stopper clapped on a fall ?
2. What is houseline ? Marline ? Spun yarn ?
3. Describe a bowsprit and its rigging, (iron work.)
4. Hoist in lower masts, all preparations having been made.
5. Reeve main-topgallant bowline.
6. Make preparations for bending a topsail.
7. Ship heads SSW. $\frac{1}{4}$ W., wind on starboard quarter, (4 points ;) how will she head when brought by the wind on the other tack ?

VII.

1. Make a short splice.
2. How are soundings called ? Call 4, 7, 10, 8, 3, and 13 fathoms, respectively.
3. Measure for and fit mizzen-topmast stay.
4. Point, rig, and rig out a flying-jib-boom.
5. Reeve a fore-royal brace.
6. Get the anchors off the bow.
7. Ship heads ESE. $\frac{1}{4}$ E. ; a sail is reported on the starboard beam ; how does it bear ?

VIII.

1. Make a studding-sail-balyard bend.
2. In hoisting a weight with a tackle, which part of the fall bears the most strain ? Why ?
3. Measure for and fit jib-stay.
4. Reeve topgallant mast-rope and fid topgallant-masts.
5. Reeve a topsail lift.
6. Name and describe the different stoppers used in connection with a chain-cable, and state how they are applied.
7. Ship heads ESE. $\frac{1}{4}$ E. on port tack ; how is the wind ?

IX.

1. Bend two hawsers together.
2. What is meant by a "thoroughfoot" in a tackle ?
3. Measure for and fit mizzen-topmast backstays.
4. Jib-boom pointed ; rig it, reeve heel-rope, and rig out.
5. Reeve a lower lift.
6. Describe the manner of surging a cable.
7. Ship heads ESE. $\frac{1}{4}$ E. on starboard tack ; how is the wind ?

X.

1. Make a long splice.
2. How is a hand lead-line marked and fitted?
3. Measure for, and fit fore-topmast backstays.
4. Place royal rigging on funnel on deck, send it aloft, and place it.
5. Reeve a main royal brace.
6. Secure an anchor for sea.
7. Ship heads N. by E. $\frac{1}{2}$ E. on port-tack; how will she head on starboard-tack?

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE INSTRUCTIONS.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1874.—*Time allowed, four hours.*

1. Station a gun's crew of sixteen men and a powderman at a broadside gun, and state what stations are omitted in reducing to fourteen, twelve, and ten men, respectively.
2. Cast loose and provide a broadside gun of sixteen men and a powderman.
3. Sponge, load, and shift breeching.
4. Shift right truck.
5. Station twenty-four men and a powderman at an 11-inch pivot-gun.
6. Give rules for division of men at guns, for boarders, riflemen, pumpmen, firemen, and sail-trimmers.
7. Shift pivot.
8. What are the charges for an 8-inch gun? What for a 9-inch gun?
9. How is a broadside gun thrown overboard?
10. What precautions are observed when the crew is suddenly called away from a gun which is cast loose?
11. Name the inspecting instruments for examining guns and explain their uses.
12. House a lower-deck gun.

DEPARTMENT OF MATHEMATICS.

STEREOGRAPHIC PROJECTIONS.

MONTHLY EXAMINATION.

NOVEMBER, 1873.—*Time allowed, two and a half hours.*

1. What is a line of measures? Prove that in stereographic projections of the sphere the distance of the projection of any point from the centre of the primitive circle is $a \tan \frac{1}{2} p$, where a denotes the radius of the sphere, and p the polar distance of the point. Deduce the corresponding expression for orthographic projections. Explain the term *subcontrary section*, and prove that the subcontrary section of an oblique cone with a circular base is a circle.
2. In what case does the projection of a circle become a straight line? What important property has this straight line? Prove that in stereographic projections of the sphere the angle between any two arcs is equal to the angle between their projections. The projection of one pole being given, show how to project the other pole, and give the reasons for the construction.
3. Project a small circle whose polar distance is 30° , (1) when the inclination of the circle is 0° ; (2) when it is 30° ; (3) when it is 90° ; (4) when it is 105° .
4. Project a spherical triangle and its polar triangle, having given: $a, 45^\circ$; $b, 60^\circ$; $C, 45^\circ$. (Take the angle C at the center of the primitive circle).
5. Project the astronomical triangle, given $L = 30^\circ$ N., $d = 30^\circ$ N., $h = 45^\circ$, (1) on the plane of the horizon; (2) on the plane of the prime vertical; (3) on the plane of the meridian: in each case the point M to be west of the meridian.

SPHERICAL TRIGONOMETRY.

MONTHLY EXAMINATION.

JANUARY 2, 1874.—*Time allowed, two and a half hours.*

1. Apply the formula $\sin^2 \frac{1}{2} A = \dots$ to the astronomical triangle to L , h , and p being given.

- | | |
|-------------------------------------|----------------------|
| Given L , $43^\circ 20' 15''$ N. | } Find t . |
| d , $6^\circ 11' 30''$ S. | |
| h , $22^\circ 29' 30''$ | |
| 2. Given A , $140^\circ 38' 45''$ | } Find a and C . |
| B , $42^\circ 33' 30''$ | |
| c , $129^\circ 21' 15''$ | |
| 3. Given A , $47^\circ 26' 30''$ | } Find C and b . |
| B , $127^\circ 30' 45''$ | |
| a , $30^\circ 13' 45''$ | |
| 4. Given t , $2^h 37^m 25^s$ | } Find h . |
| d , $18^\circ 20' 30''$ N. | |
| L , $40^\circ 35' 45''$ N. | |
| 5. Given t , $1^h 59^m 59^s$ | } Find L . |
| d , $15^\circ 00' 45''$ S. | |
| h , $60^\circ 00' 30''$ | |

Make a stereographic projection of this triangle on the plane of the equator, only given parts in the construction.

PLANE TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. What is the sine of an angle? The versed sine? The tangent? What are the limiting values of each of these functions? Show how the log sin or log tan of an angle may be found. Apply this method to find log cot $11^\circ 30'$. Prove the following formulas:

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

What rule is to be followed in taking from the tables the logarithms of the trigonometric ratios of the angle $\left[\frac{n\pi}{2} + y \right]$, n being any whole number? What is meant by the *natural* sine of an angle?

2. What is a logarithm? A common logarithm? A Napierian logarithm? How is the Napierian logarithm of any number be found from a table of common logarithms? What quantities have negative logarithms? What quantities have no logarithm? Find the number whose logarithm is $-(0.37568)$. How is such a logarithm written?

When is a quantity said to be a function of another quantity? When an explicit function, and when an implicit function?

3. Find x from the formula—

$$x = \frac{\sin a \cos b \tan c \tan d \sec e}{\tan f \cos g \sin h}$$

having given—

- | |
|---------------------------|
| a , $-31^\circ 30'$ |
| b , $217^\circ 20'$ |
| c , $131^\circ 15'$ |
| d , $416^\circ 29'$ |
| e , $89^\circ 45' 30''$ |
| f , $337^\circ 45'$ |
| g , $90^\circ 3'$ |
| h , $783^\circ 5'$ |

4. Deduce expressions for the sine, cosine, and tangent of $(x \pm y)$.

5. What is meant by the expression $u = \sin^{-1} x$? Given $x = 2$, find the value of u in terms of π in each of the following equations:

$$u = \sin^{-1} \frac{x}{4}$$

$$u = \tan^{-1} \frac{x}{2}$$

$$u = \operatorname{vers} \sin^{-1} x$$

Given $u = \tan^{-1} x$, find an expression for $\sin 2u$ in terms of x .

Find the numerical values of the sine, cosine, and tangent of $\frac{\pi}{6}$ without using the tables and simply indicating the square roots.

6. Find u from the equation—

$$u = \tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{4}.$$

Given $\operatorname{cosec} 2x - \sin 2x = \tan x$, find an expression for $\sin x$.

7. What precept is to be employed in the solution of plane right triangles?

Prove that in any plane triangle—

$$\frac{a+b}{a-b} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$$

and that—

$$a^2 = b^2 + c^2 - 2bc \cos A$$

8. Deduce an expression for $\sin^2 \frac{1}{2} A$ in an oblique triangle. Write expressions for $\cos^2 \frac{1}{2} A$, $\tan^2 \frac{1}{2} A$, and K .

9. Given—

$$c, 2.7153$$

$$y, 4.5672$$

$$x, 3.0041$$

$$\pi, 3.1416$$

find u from the equation—

$$u = c \tan^{-1} \frac{y}{x}$$

10*. A ship was sailing SW, at the rate of 10 miles an hour. At 9 a. m. a light-house bore SSW, and at 11 a. m. the same object bore E. by N. How near to the light-house did the ship pass?

10*. Two hills, AB and AC , rise from the same point. The inclination of AC to the horizon is α , and that of AB is β . At a point a feet from A on AC , the angles of elevation of the bottom and top of a vertical object on the top of the other hill are α_1 and β_1 respectively. Deduce a formula by which x , the height of the object, may be found when α , α_1 , β , β_1 and a are given. Also, find x , having given the values—

$$\alpha, 30^\circ 15'$$

$$\alpha_1, 37^\circ 30'$$

$$\beta, 55^\circ 30'$$

$$\beta_1, 32^\circ 45'$$

$$a, 128 \text{ feet}$$

SPHERICAL TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—Time allowed, five hours.

1. Enunciate and prove the two fundamental theorems of spherical trigonometry. Apply the formula obtained in each case to the polar triangle.

2. Deduce directly from the fundamental theorems all the formulas used in the solution of spherical right triangles. Show how all these formulas may be comprehended under two simple rules.

3. Deduce an expression for $\cos^2 \frac{1}{2} A$ in an oblique spherical triangle, and apply the result to the polar triangle.

4. Assuming the formula—

$$\tan^2 \frac{1}{2} A = \frac{\sin(s-b) \sin(s-c)}{\sin s \sin(s-a)}$$

deduce the second and fourth of Napier's analogies.

5. In a spherical right triangle, $a = 115^\circ 25' 30''$, $b = 165^\circ 33' 25''$; find the other parts. What is a quadrantal triangle, and how are the formulas for its solution derived?

6. $A = 110^\circ 20' 30''$, $B = 78^\circ 29' 30''$, $c = 48^\circ 30' 30''$. Find C and b .

7. Given $t = 2^h 35^m 28^s$, $d = 13^\circ 5' 30''$ N., $L = 30^\circ 20' 30''$ S., find h and Z .

8. $A = 45^\circ$, $B = 105^\circ$, $a = 45^\circ 30'$; find C and b , and make a projection of the triangle, using only given parts in the construction.

9. Find Z when $h = 44^\circ 59' 30''$, $d = 30^\circ 02' 10''$ N., and $L = 29^\circ 45' 30''$ N. Make a projection of this triangle on the plane of the meridian, using only given parts in the construction.

ANALYTICAL GEOMETRY.

MONTHLY EXAMINATION.

FEBRUARY 14, 1874.—Time allowed, two and a half hours.

1. Construct the locus of each of the equations $y - 2x + 2 = 0$, and $x^2 + y^2 + 10x - 8y = 23$ on the same axes (unit, $\frac{1}{4}''$). Find the co-ordinates of the centre of the curve and the co-ordinates of the points of intersection of the two loci.

2. Construct the locus of the equation $9y^2 + 6xy + 35y + x^2 + 43x - 103 = 0$ (unit, $\frac{1}{4}''$). Find what this equation becomes when the origin is moved to the point $(0, -6)$. Through what angle must the axes be revolved in order that a diameter may be parallel to the axis of X ?

3. Construct the locus of the equation $64y^2 + 16xy - 160y - 24x^2 + 80x + 200 = 0$ (unit, $\frac{1}{4}''$); and find the co-ordinates of the centre.

4. Construct the locus of the equation $36y^2 - 24xy + 29x^2 - 180 = 0$ (unit, $\frac{1}{4}''$); and find what the equation becomes when the axes are revolved through $\cos^{-1} \frac{1}{2}$.

5. What locus is represented by the equation $x = y$? by $r = 10$? by $\theta = \tan^{-1} \sqrt{3}$? Deduce the equation to the straight line in terms of its intercept on the axis of Y and the direction-ratio. Deduce the equation to the straight line in terms of the intercepts. Find the angle between the two lines $4y - 3x + 7 = 0$, and $3y - 4x + 9 = 0$.

MONTHLY EXAMINATION.

APRIL 24, 1874.—Time allowed, two and a half hours.

1. Define the *cardioid*, the *lemniscata*, the *cissoid*, and the *conchoid*. Deduce the rectangular equation to the latter, and thence the polar equation. Show by sketches the different forms this curve may assume.

2. Two fixed lines make an angle a with each other. A line of fixed length moves with one of its extremities in each of the fixed lines; taking these fixed lines as axes, deduce the equation to the locus of a point on the moving line, the distances of the point from the ends of the line being a and b .

3. Define the common cycloid and the curtate and prolate cycloids, and make a sketch of each. What is an epi-cycloid? a hypo-cycloid? Deduce the equation to the common cycloid. Make a sketch of the locus of the equation $y = a \sin \frac{x}{a}$; what is this locus called?

4. Find the locus of the point in which the perpendicular from the center of an equilateral hyperbola upon a tangent meets the ordinate to the point of contact. Find the locus of the point in which the perpendicular from the vertex of a parabola upon a tangent meets the ordinate to the point of contact.

5. Trace the locus of each of the following equations: (1) $y^2 = a^2(x^2 - x^4)$; (2) $y^2 = ax^2 - x^3$; (3) $r = a \cos 2\theta$.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, five hours.

1. Find the equation to the circle passing through the three points $(-3, 9)$, $(-2, 3)$ and $(-10, 2)$, its radius, and the co-ordinates of its centre. Find the equations to

3. straight lines joining these points, and the angles and area of the triangle so med.

4. Give a general definition of a conic. Define the hyperbola, and deduce its rectangular equation in its simplest form. Show what this equation becomes in terms of a and c , when the origin is taken at the right-hand focus. Discuss the result, giving different values to c , and illustrate by diagrams.

5. Deduce the equations to the tangent and normal to the ellipse in terms of the eccentricity, and also in terms of the co-ordinates of the point of contact, (x_1, y_1) . Deduce expressions for the subtangent and subnormal.

6. Define *diameter* and *conjugate diameters*. Deduce the equation to the parabola, taking for axes any diameter, and the tangent at its vertex.

7. Find the locus of the foot of a perpendicular let fall from a focus of the ellipse, upon a tangent; of the intersection of perpendicular tangents to the hyperbola; and of the foot of a perpendicular let fall from a point in the circumference of the circle upon the tangent.

8. Explain what is meant by the *eccentric angle*, and show how the eccentric angle of a point on an ellipse may be constructed.

Find the relation between the direction-ratios of conjugate diameters of the ellipse.

In the ellipse $a^2 y^2 + b^2 x^2 = a^2 b^2$, find the equations to a pair of conjugate diameters, one of which passes through the point (b, a) .

9. State what locus is represented by each of the following equations:

$$\begin{array}{ll} xy + x^2 - y = 0 & y^2 - 2xy - 3x^2 - 2y + 7x - 1 = 0 \\ (x + y)^2 = 2(x - y) & y^2 - 5xy + 6x^2 - x - y - 12 = 0 \\ x^2 + xy + y^2 = 25, 4 & y^2 - 4xy - 16y + x^2 + 17x - 20 = 0 \end{array}$$

Construct the locus of the last equation. Construct the axes and directrix of this locus, and draw a tangent to it at the point $(0, 5)$. Write the equation to this tangent.

10. The distance from a vertex of a hyperbola to the nearest focus is 1.0, and the double ordinate through the focus is 4.5. Find the equation to this hyperbola referred to its axes. Find the equations to the asymptotes, and the equation to the conjugate hyperbola. Find the equations to tangents to the given hyperbola passing through the positive extremity of its conjugate axis.

11. Trace the locus of each of the following equations:

$$\begin{array}{l} a^3 y = a^2 x^2 - x^4 \\ r = a \cos 3\theta \\ x^3 + y^3 - 3axy = 0 \end{array}$$

Find the equations to the asymptotes of the curve represented by the equation—

$$xy^2 = 4x^3 + 4x^2 + x + 6$$

12. The base of a triangle is $2c$, and the product of the other two sides is m^2 . Taking a perpendicular to the base, at its middle point, as the axis of ordinates, find the equation to the locus of the vertex.

Find the polar equation to this locus in the particular case when $m = c$, and trace the curve.

13. Find the locus of the intersection of a tangent to a conic section with a straight line drawn through the focus at right angles to the radius-vector of the point of contact.

DEPARTMENT OF PHYSICS AND CHEMISTRY. CHEMISTRY.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, four hours.

1. Define chemistry in terms of the modern theories of the molecular and atomic constitution of matter. What is the meaning of analysis and of synthesis in chemistry?

* Alternatives.

2. How many cubic metres of air would be required by a blast-furnace, consuming coal equivalent to 20 metrical tons of carbon per diem?
3. What is meant by galvanic protection of metals by each other? Discuss the principle involved, and illustrate by practical examples.
4. Explain the chemical principles of photography, and describe the usual process.
5. Explain the cause and means of prevention of the incrustation of steam-boilers: (1) when fresh water is used; and (2) when sea-water is used.
6. What is the composition of zinc-white, and why is it preferable to lead-paint on ship-board?
7. Why is potassium nitrate preferred to sodium nitrate for making gunpowder? Under what circumstances can the latter be used, and with what advantage?
8. What chemical compounds constitute the ordinary ores of iron, copper, lead, tin, silver, and gold?
9. What are the products of the combustion of illuminating gas, and how much of them, in volume, will a five-foot burner produce per hour?
10. Why is plaster so long in drying or setting, in confined rooms? Discuss the chemical principle involved, and state how the process can be hastened.
11. Explain spectrum-analysis briefly. What special service has it rendered to chemistry?
12. What is steel? Explain the Bessemer process.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

HISTORY OF THE UNITED STATES.

SEMI-ANNUAL EXAMINATION.

JANUARY 30, 1874.—*Time allowed, five hours.*

[A number marked with an asterisk (*) may be substituted for the same number not so marked.]

1. Colony of Virginia: 1606, 1609, 1612, 1619, 1624. Explain fully the political significance of each of these dates.
 - 1*. Give the history and boundaries of the three divisions of Maine, with dates. Name the colonies in 1688, and state the form of government in each at that time.
2. Congregationalism, Presbyterianism, Episcopacy. Compare, showing political tendencies.
 - 2*. 1644, 1663, 1840: Rhode Island [*in full*].
3. Name the thirteen acts of Parliament which led directly to the Revolution, giving dates, and referring each to the ministry in which it was passed. Describe any two of these acts.
 - 3*. Four colonial wars: dates; causes; corresponding war in Europe; treaties. State the territorial changes accomplished by the last three. Connect the last colonial war with the Revolution.
4. (1) Writs of assistance [1761]; (connect with IV. Article of Amendments). (2) Boston Tea-party. (3) Shays's insurrection. (4) Northwest Territory. (5) Mission of Genet. (6) Chesapeake and Leopard. (7) Dred Scott decision. (8) Topeka constitution.

Take four.
5. Second period of the Revolutionary War [April, 1776—July, 1778].
 - 5*. Navy in the War of 1812.
6. Administrations, 1789—1860: Dates; President and Vice-President.

Refer the following to the administrations in which they occur: (1) Embargo; (2) Florida purchase; (3) Tariff compromise; (4) Webster-Ashburton treaty; (5) Gadsden purchase.
- 6*. Parties, 1830—1860.
7. Connect the Missouri compromise with the Kansas-Nebraska act. Seward said 1854, "The day for compromises is past forever." Explain.

7*. Webster, Jackson, Calhoun: three theories of the Constitution and the Union.

8. Explain the continuity of American institutions, (1) as to Federalism, (2) as to Republicanism, in the form of a threefold distribution of powers.

8*. Articles of Confederation: origin; duration; defects. How does the Confederation form a break in American history?

9. Explain briefly any four of the following: (1) Cabal; (2) Tariff; (3) Excise; (4) Protective system; (5) Ministerial policy [before 1776]; (6) Squatter sovereignty; (7) Personal liberty bills; (8) Localization of parties.

10. Place (1) Fort du Quesne, (2) Louisburg, (3) Eutaw Springs, (4) Plattsburg, (5) Nueces River, (6) Mesilla Valley.

Fix the boundaries of the territory from which slavery was excluded by the Missouri compromise.

RHETORIC.

ANNUAL EXAMINATION.

MAY 25, 1874.—*Time allowed, five hours.*

[* Starred questions are alternatives.]

I.

1. State, in your own language, the aims of linguistic science.
2. What was the old theory of the origin of language, and how did it come to be rejected?
3. Explain fully the ethnographical theory of the growth of languages.

I*.

1. Explain the names used to designate the Indo-European family of languages.
2. Name the seven groups of this family, and classify the sub-groups under each head, stating where and by whom the languages mentioned are spoken, and designating those that are extinct.

II.

Compare the influence of Latin on early English with that exerted on the language of Gaul, and state the historical reasons for the difference.

II*.

1. Describe the policy of the Norman conquerors of England, and from this explain in full the extent and character of Norman influences on the language.
2. Name and describe the two classes of Latin words that have found their way into English.

III.

1. What is meant by purity of diction?
2. Name and characterize the four kinds of barbarisms, and point out the objections in each case.

III*.

1. Name and define the three essential qualities of style.
2. What is meant by the "suspended animation" of words?

IV.

State in full the points to be considered in order to attain (1) clearness, (2) emphasis.

V.

1. What is meant by strength in a sentence?
2. What is the objection to redundancy?
3. What is the effect of frequent intensives?
4. Explain the phrase *splitting particles*, and show how the error thus designated is to be avoided.

VI.

1. "The cares that infest the day
Shall fold their tents like the Arabs,
And as silently steal away."

Explain both the figures.

2. "Some characters cannot determine on any course of action, because they always standing at the cross-roads, and see the disadvantages of every one of them."
- Explain the figure.

VII.

1. "The sun of liberty is set; Americans must light the lamp of industry economy."

Turn the metaphor into a simile.

2. "Take arms against a sea of troubles."

Point out the fault.

3. "American life is *orphaned* of all the sweet delights of antiquity."

Explain the figure in this sentence, and the meaning of the word in italics.

VIII.

1. Explain *antithesis*, *epigram*, *asyndeton*, *paradox*, *synecdoche*, *mixed metaphor*.
2. Give two explanations of the origin of figures.
3. What is the effect of the excessive use of metaphors?

IX.

Write a detailed report of the grounding of a United States vessel, while under your command, on Nantucket Shoals, and describe the means employed in getting ship off.

IX. question has double weight.

Papers to be submitted, folded, and endorsed according to regulations.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN QUESTIONS.

Translate into French :

I.

The axis of the earth is an imaginary line passing through the centre, upon which the whole earth turns; the poles are the extremities of the axis.

II.

Of all living creatures, man is the only one that has not his face turned toward ground; he walks with his forehead turned toward heaven.

III.

Upon the ocean-path, along which one sees neither trees, nor villages, nor cities, tombs, the meeting of two ships is a memorable event.

IV.

The generals were mounted on beautiful horses and wore velvet hats, ornamented with large jewels; the lieutenant-colonels had gold crosses hanging from their button-holes; and the noblemen wore green satin coats with large silver buttons.

V.

A beautiful woman has a powerful charm which excites our admiration; she attracts our admiration by the regular qualities of body, and the agreeable union of the rose-lily in her complexion: a pretty person interests us by her pleasing manners.

ORAL EXAMINATION.

1. How is a phrase rendered negative in French ?
2. Explain the rules of contraction and elision.
3. If a noun is taken in a partitive sense, and is preceded by an adjective, does it require any preposition ?
4. What is the place of adjectives in French ?
5. Give some adjectives which do not follow the general rule of position.
6. Tell all about demonstrative pronouns and their variations.
7. How do nouns and adjectives form their plural ?
8. How do adjectives agree with the nouns qualified ?
9. What part of speech follows adverbs of quantity ?
10. Is the relative pronoun *que* or the conjunction *que* ever omitted in French ?
11. In speaking of the days of the month, what numbers do the French employ ?
- What verb is used in speaking of the time of day ?
12. Give the conjugations and their terminations.
13. Give the idioms formed with the verb *avoir*.
14. Give the idioms formed with *aller* and with *faire*.
15. State the place of pronouns when used as objects.
16. What words are placed before titles and designations of relationship, in respectful address ?
17. Define a *unipersonal verb*, and give examples.
18. What is the place of adverbs in French ?
19. What are reflexive verbs ? Conjugate one.
20. What is the meaning of *se passer* ? Of *se servir* ?
21. Explain the agreement of past participles.
22. How are passive verbs formed in French ?
23. Explain the imperfect tense and its use.
24. Explain how compound nouns form their plural.

Translate into English :

Pendant le siège d'Anvers, en 1832, les deux fils aînés du roi, les ducs d'Orléans et de Nemours, se distinguèrent par le courage avec lequel ils partagèrent les dangers et les fatigues du siège. Un jour que le duc d'Orléans était à la tranchée, les balles parties des remparts sifflaient si près des soldats que par un mouvement involontaire plus d'un baissait la tête. Le prince s'avança au milieu d'eux : "Soyez tranquilles, mes amis, les Hollandais tirent trop haut. Voyez, je suis plus grand que vous, et leurs balles ne me touchent pas la tête." Et cependant plus d'une balle vint frapper juste pendant une demi-heure environ que le jeune duc resta au milieu des soldats, s'entretenant avec eux, et leur donnant l'exemple du sang-froid.

Conversation : Conjugation of verbs.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SHIP-BUILDING.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—Time allowed, four hours.

1. Describe building-slips (permanent and temporary) and building-blocks. Describe the keel, and explain the manner of scarfing the different lengths together. Describe the stem and stem-framing, and explain the manner of uniting them to the keel.
2. Describe the frame, and explain fully the manner of uniting the different pieces. Raise and regulate the frame of a ship. Describe diagonal bracing and state its use.

3. Describe the forward and after cants, the hawse-pieces and knight-heads, the side and centre counter-timbers, and state the use of each. Explain breast and deck hooks, and state the uses of each. What are chocks? fillings? State the uses of each.
4. Describe a deck-beam, and state fully its uses and the manner of securing it to the ship's side. Explain the manner of framing a deck. State what is meant by a deck plan, and tell what it must show.
5. Describe the different bitts in use on board ship. Describe the capstan in general use. Describe the different kinds of rudders now in use. Describe the manner of constructing carvel and clinker-built boats.
6. Describe the different kinds of docks used for docking vessels in this country.
7. The ship being completed, construct the ways and cradle for launching her. Describe each fully.
8. All preparations being made, at the proper time launch the ship.

NAVAL TACTICS.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, four hours.

1. Explain the organization of a fleet of 12 or more vessels, and state the position of the division and squadron commanders according to rank.
2. Name and describe the three general formations of a fleet. State when a fleet in line or column is in *natural* order, and when in *reverse* order. When is a fleet in *double échelon* in the *natural* order? when in the *reverse* order? when in *inverted* order? and when in *reverse inverted* order?
3. State the distance between vessels at half distance, close order, and open order.—[Construct a table.]
4. The fleet being in column of vessels, abreast by divisions, in *natural* order, heading north, change direction to any course to the northward of east or west, preserving the *natural* order.
5. With the fleet in line, if signal be made "From the right of fleet form column of vessels, fleet right oblique, right vessel forward," what will be the relative speed of the right vessel, and any vessel on her left? Explain by diagram.
6. State, and explain by diagram, the rule for keeping away to re-form the column on a shift of wind, (1) when the wind hauls ahead, (2) when the wind veers aft.
7. Fleet in column of vessels, on starboard tack, in *natural* order, change to column of vessels, abreast by divisions, in *natural* order, on the other tack.
8. Fleet in column of vessels under sail, change to double *échelon* from the centre vessel, heading 8 points to leeward.

SEAMANSHIP.

ORAL EXAMINATION; SPECIMEN QUESTIONS.—MAY, 1874.

I.

1. By the wind, heave to, to sound; to lower a boat.
2. Set top-gallant sails, moderate breeze, yards braced up.
3. Send down top-gallant and royal yards. (Port routine.)
4. Make preparations for heaving up an anchor.
5. Reeve lower studding-sail clewline.
6. Measure for fore-stays.
7. Rig a bowsprit.

II.

1. Take two reefs in the courses.
2. Set a mainsail, moderate breeze, yards braced up.
3. Secure yards for purchasing a sheet-anchor.
4. Get the anchors off the bows.
5. Reeve topsail reef-tackles.
6. Shears alongside, get them on board and rig them.
7. Set up topmast backstays.

III.

1. Wind on port quarter, and veers directly aft: what is to be done?
2. Set a lower studding-sail.
3. Bend topsails, courses, jib, and spanker.
4. Make up a topmast studding-sail when bent.
5. Reeve a mizzen-royal brace.
6. Measure for and fit jib-guys.
7. Sway a topsail yard on board.

IV.

1. Wear ship short around.
2. Take in a mainsail, moderate breeze, yards braced up.
3. Boat alongside, manned, take charge, pull away from the ship; give all the orders and state how they are executed.
4. Get chains on board and secure them.
5. Reeve jib down-haul.
6. Shears being in place, mizzen-mast on shore, hoist it on board and step it: (ship in the stream.)
7. Measure for and fit royal backstays.

V.

1. By the wind, man falls overboard; what is to be done?
2. Take in the topsails, as in coming to an anchor.
3. Describe, in detail, the manner of crossing a royal yard.
4. Range a chain-cable.
5. Reeve flying-jib halyards.
6. Measure for and fit top-gallant shrouds.
7. Send aloft and rig a top-gallant studding-sail boom.

VI.

1. Wear ship, under all plain sail, fresh or moderate breeze.
2. Set the courses, moderate breeze, yards braced up.
3. Hoist out launch, port side.
4. Bend a chain-cable.
5. Reeve a main brace.
6. Reeve laniards and set up lower rigging.
7. Hoist a jib-boom on board and point it.

VII.

1. Tack ship, under double-reefed topsails, courses, jib, and spanker.
2. Haul down and stow the jib, blowing fresh.
3. Get guns on board through the gun-deck ports.
4. Bring to on a cable.
5. Reeve fore brace.
6. Stay lower masts.
7. Topmast pointed: rig it.

VIII.

1. Before the wind, heave to, with fore-topsail to the mast.
2. Take in a foresail, before the wind.
3. In a boat, station the crew for reefing, and reef.
4. Describe a chain-messenger, and the manner of using it.
5. Reeve topsail buntlines.
6. State in what order the rigging goes over the fore-topgallantmast head.
7. Ship a topmast-cap.

IX.

1. Before the wind, heave to, with the main topsail to the mast.
2. Set a foresail before the wind.
3. Boat pulling for the ship; you are in charge, come alongside, give all the order and state how they are executed.
4. Describe iron nippers, devil's claws, and stoppers.
5. Reeve main buntlines.
6. Rig the fore royal funnel.
7. Rig a spanker-gaff.

X.

1. By the wind, under all sail, to reduce sail to a squall.
2. Set a foresail, moderate breeze, yards braced up.
3. Transport an anchor from the waist to the bow.
4. Secure an anchor for sea.
5. Reeve spanker-sheets.
6. Ship in the stream; make preparations for getting shears on board.
7. Rattle-down lower rigging.

DEPARTMENT OF ORDNANCE AND GUNNERY.

INFANTRY TACTICS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, four hours.*

1. Give the formation of a regiment in order of battle, with posts of all commission officers and non-commissioned officers.
2. Describe the position of carry arms; the change from carry to support; from support to right shoulder shift; from right shoulder shift to carry; from carry to secure from secure to carry.
3. Fire by company; by rank; by file.
4. Form company, count fours, and complete left fours.
5. Wheel from a halt while on the march.
6. Form column of twos, from fours, and re-form column of fours.
7. Execute fours-right-about in column and in line.
8. Being in column of fours, form line to the front.
9. State the different ways of deploying a company as skirmishers.
10. Rally by fours; rally on centre skirmisher; assemble on centre skirmisher.

GUNNERY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

1. *Production of gun-iron.* Describe the processes of obtaining pig-iron from the ore. Describe the blast-furnace, and the method of working it; character and effect of different blasts; chemical action in the furnace.
2. Define wrought iron. Describe the refinery, and the puddling-furnace; the method of rolling armor-plates from puddle-balls.
3. Define steel. How is it classified? Describe the processes of production of the different classes. Describe the Bessemer process.
4. Give the details of the manufacture of the XV-inch gun; the preparation of the mould, core, and pit; the method of charging the furnace and melting down the charge; casting; cooling.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ASTRONOMY.

MONTHLY EXAMINATION.

MARCH 25, 1874.—*Time allowed, two hours.*

1. Find an expression for the aberration of light in terms of the velocity of the earth in its orbit, of the velocity of light, and of the apparent direction of the body. Define diurnal aberration and annual aberration. If the maximum value of aberration is $20''.4$, what is the velocity of light?
2. Define sidereal day; solar day; sidereal time; solar time. Give the value of a sidereal year in sidereal and solar days. Show the difference between the Julian and the Gregorian calendar. Which is now in use?
3. Give the general laws of the tides so far as the moon is concerned. Define *common* and *corrected* establishment, and state how the time of high water at a given place is found by means of the corrected establishment. Of the two daily tides, which rises higher? When does the highest tide occur, and what is it called? When does the lowest tide occur, and what is it called?
4. Give Newton's law of universal gravitation. What is the mass of the sun, and how is it found? Define astronomical and civil time.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. Define vertical circles; celestial equator; prime vertical; hour-circle; declination; right ascension; celestial latitude and longitude; sidereal day; solar day; sidereal time; solar time; sidereal and tropical year; synodical period; amplitude; right ascension of the meridian; geocentric and heliocentric parallax; azimuth; altitude astronomical time; and civil time.
2. Discuss fully the equation of time. Define it in terms of the sun's longitude and right ascension as well as in hour-angles. At the autumnal equinox, what is its sign of application to apparent time? Give the reasons for your answer.
3. Give the facts and experiments that lead to a positive knowledge that the earth rotates on its own axis.
4. Name the different kinds of lunar eclipses. Find an expression for the semi-angle of the umbral cone; for the angular semi-diameter of the shadow at the distance of the moon; for the length of the earth's shadow; and for the lunar ecliptic limits in terms of parallax and semi-diameter. State when an eclipse must occur.
5. Show how to find the inclination of a planet's orbit to the plane of the ecliptic. How is the distance of a *superior* planet from the sun found from observations made at the time of opposition? Deduce the formula for finding the approximate mass of a planet which is attended by a satellite.
6. Explain the method of determining the latitude of an observatory by means of a circumpolar star, and the method of finding the latitude of a station of a survey by means of two stars.

Why is the first used at observatories, and the second at stations of a survey?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY.

ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. Describe the construction and action of the electrophorus, and of the Carré electrical machine.
2. Describe Thompson's electrometer, and explain its action. What was Faraday's theory of induction?

3. How may the condensing force of the Epinus condenser be calculated? Show how Wheatstone measured the duration of the electric spark, and the velocity of electricity in a wire.

4. What causes the polarization of electric batteries, and what means are used to prevent it in Daniell's, Grove's, and Bunsen's batteries? Describe Grove's battery, and the chemical reactions that take place while it is in action.

5. Discuss Ohm's law.

6. How should a battery of 45 cells, each with an internal resistance of 2 units, be set up in order to overcome an external resistance of 11 units? What are the four most important of Faraday's laws of electrolysis?

7. What is Ampère's theory of magnetism? Give briefly the history of the electric telegraph. Describe the Morse telegraphic apparatus and its action.

8. Prove that the intensities of currents are proportional to the tangents of the corresponding angles of deflection of the tangent-galvanometer needle. What are the laws of the heating effects of the electric current?

9. Explain the inductive action of magnets on bodies in motion. Explain how a magnet may be made to rotate by a current from a battery.

10. What is diamagnetism? What would be the effect upon a thermo-electric pile, if a current from a battery were passed through it?

11. What is the cause of the magnetization of iron ships? How may the influence of this magnetism be compensated?

MECHANICS.

MONTHLY EXAMINATION.

NOVEMBER, 1873.—*Time allowed, two hours and fifteen minutes.*

1. Deduce the relation between the power and the weight in the case of the lever with friction.

2. Apply the same method to finding the force exerted at the end of the elevating screw in depressing an XI-inch gun, the centre of gravity of the gun being 2' in rear of the axis of the trunnions, and the elevating screw 3' 4" from the same point; diameter of trunnions, 9 $\frac{1}{4}$; weight of gun, 16750 pounds; co-efficient of friction, $\frac{1}{4}$.

3. A right prism of cast iron, having a base 2' square, rests on an inclined plane of oak, and is on the point of both overturning and sliding down; find the height of the prism, the co-efficient of friction between oak and cast iron being 0.65.

4. It is found that a man pulling 125 pounds on a double Spanish burton, which leads at an angle of 30° with the deck, which is horizontal, can just move a weight along the deck, the co-efficient of friction between the weight and the deck being $\frac{1}{\sqrt{3}}$; required the weight.

5. Find the least force necessary to draw a weight of 25 tons up a rough inclined plane, μ being $\frac{1}{4}$, and the inclination of the plane being such that 7 tons acting along the plane would support the weight if the plane were smooth.

MECHANICS AND DIFFERENTIAL CALCULUS.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1874.—*Time allowed, five hours.*

MECHANICS.

1. Find the ratio between the power and the weight in the case of Hart's elevating screw; explain briefly how each equation is derived from the preceding equation.

2. A cord made fast at one extremity A passes under a movable pulley B sustaining a weight of 13 pounds, and then over a fixed pulley, C, and has a weight of 10 pounds

made fast to the other end, the end A and the fixed pulley C being in the same horizontal plane; find the length of the cord A B C when the system is in equilibrium, the size of the blocks being neglected, and A C being 6 feet.

3. The foot of a frigate's main topsail is 90 feet long, and the head 70 feet long; find the hoist in order that the centre of effort may be $28\frac{1}{2}$ feet above the foot.

4. A solid is formed of a hemisphere and a cone having a common base; find the height of the cone when the solid rests in equilibrium on any point of the spherical surface.

5. A capstan has 8 bars, each projecting $8'$ from the axis; the barrel, around which the rope has 3 turns, is $14''$ in diameter, and the rope is $2''$ thick; a man exerting a force of 60 pounds heaves on the end of each bar, the co-efficient of friction being $\frac{1}{2}$, and π $\frac{1}{2}$; find the tension on each end of the rope in hoisting a weight.

6. A hemisphere rests with a point in the circumference of its base upon a rough horizontal plane, and a point in the convex surface in contact with a rough vertical wall; the co-efficient of friction between the wall and the solid being the same as that between the floor and the solid; find its value, supposing the hemisphere just supported with its base in a vertical plane.

7. At what distance from a hatch-coaming must a shot-rack for a $11''$ shot be placed in order that the shot may not topple out until the ship is heeled more than 45° ?

DIFFERENTIAL CALCULUS.

1. Deduce the differential of $\log x$, determining the constant.

2. The work of driving a steamer through the water being proportional to the cube of her speed, find her most economical rate per hour against a current running a knots per hour. (*For Cadet-Engineers only.*)

3. Differentiate the functions:

$$u = \frac{x}{a^2 \sqrt{a^2 - x^2}},$$

and

$$u = \log x + \sqrt{a^2 + x^2}.$$

4. Differentiate

$$u = \log \tan \left(c \sqrt{x} \right),$$

and

$$u = \frac{1}{\sqrt{3}} \tan^{-1} \frac{2x-1}{\sqrt{3}}.$$

5. A high vertical wall is to be supported by a shore which must pass over another wall $6\frac{1}{2}'$ high, and $16'$ distant from the first wall to which it is parallel. What is the length of the shortest beam that can be used for this purpose?

6. A steamer, whose speed is 8 knots per hour and course due north, sights another steamer directly ahead, whose speed is 10 knots and whose course is due west. What must be the course of the first steamer to cross the track of the second at the nearest possible point?

7. A nun-buoy is constructed of boiler-iron in the form of two equal cones having a common base. Find the ratio between the altitude and the radius of the base of each cone, in order that the buoy's buoyancy may be the greatest possible.

8. Derive the logarithmic series—

$$\log(x+1) = \log x + 2 \left\{ \frac{1}{2x+1} + \frac{1}{3} \frac{1}{(2x+1)^3} + \frac{1}{5} \frac{1}{(2x+1)^5} + \&c. \right\}$$

9. Given $\log_e 2 = 0.6931472$, and $\log_e 3 = 1.0986123$, and $\log_e 5 = 1.6094379$, find $\log_e 271$.

10. The top-gallant sail being furled, and the top-gallant sheets taut, show that it is necessary to slacken the sheets in hoisting the topsail-yard, but that they may be kept taut when lowering it. (*For Cadet-Midshipmen only.*)

INTEGRAL CALCULUS.

MONTHLY EXAMINATION.

FEBRUARY 26, 1874.—*Time allowed, two hours and twenty minutes.*

[Any one of the first three questions may be omitted.]

1. $\int_0^{2a} \frac{x dx}{\sqrt{2ax - x^2}}$ and $\int \frac{dx}{1 + \cos x}$.
2. $\int \left\{ \log \frac{x}{a} \right\}^3 dx$ and $\int \frac{dx}{\cos x}$.
3. $\int (x^8 + a^3)^{\frac{7}{2}} x^{15} dx$ and $\int \frac{dx}{\sqrt{1 - 3x - x^2}}$.

4. Find the centre of gravity of a paraboloid and of a hemisphere.
5. Find the whole area of a curve whose equation is $y^2 = x^2(25 - x^2)$; and find the area of a cycloid.
6. Find the volume generated by the revolution about the axis of x of the curve whose equation is $y^2(a^2 + x^2) = a^2x^2$, between the limits a and 0. Find also the volume of a frustum of a cone, in terms of the radii of the two bases and the distance between them.

MECHANICS AND APPLIED MATHEMATICS.

MONTHLY EXAMINATION.

MARCH, 1874.—*Time allowed, four hours.*

1. Define work and unit of work. Deduce an expression for the work accumulated in a body moving with any velocity. Find the work done in moving a body through any space up a rough inclined plane.
2. Deduce the equation to the trajectory of a projectile in a non-resisting medium. Find the greatest height reached, time of flight, and range, on a horizontal plane.
3. (a) Two projectiles fired from the same point, with the same initial velocity, but at different angles of elevation, have the same range on a horizontal plane; find the ratio of the times of flight. (b) A shot is 600' above the horizontal plane at 800' from the gun, and strikes the plane at 3200'; find the angle of elevation and the initial velocity.*
4. A body weighing 5 pounds, resting on a rough horizontal table, (co-efficient of friction, 0.5,) is connected by a string passing over a fixed smooth pulley at the edge of the table, with a weight of 10 pounds, which is free to descend vertically; find the vertical and horizontal components of the acceleration of the motion of the centre of gravity of the system.
5. A horizontal plane is descending with a velocity of 32' per second, when a ball is dropped from a point 48' above it; the elasticity being perfect, find the distance between the highest point of the rebound and the point from which the ball started.
6. Find the pressure of a man weighing 180 pounds on the car of a balloon, which is rising vertically with an acceleration of 16' per second.
7. A heavy box, 8' high and 6' square, stands on the deck of a ship, with one edge perpendicular to the line of the keel; supposing the box not to slide, what must be the velocity of the ship if, when she is brought up suddenly, the box just topples over?
8. A shot weighing 6 pounds leaves the muzzle of a gun with a velocity of 1,000' per second; determine the mean pressure of the gases on the shot, if the distance from the seat of the shot to the muzzle be 5'.
9. Find at what rate an engine of 30 horse-power could draw a train weighing 50 tons up an incline of 1 in 280, the resistance from friction being 7 pounds per ton.

* Take either (a) or (b).

MECHANICS AND INTEGRAL CALCULUS.

ANNUAL EXAMINATION.

MAY 26, 1874.—Time allowed, five hours.

[Any two examples may be omitted.]

1. (a) $\int \frac{dx}{\cos x},$

(b) $\int \sqrt{2ax - x^2} dx.$

2. (a) $\int \frac{4x dx}{x^4 - 8x^2 + 16},$

(b) $\int \frac{dx}{\sqrt{18x - 7x^2}}.$

3. Find an expression for the area common to the curves $x^2 = 3ay$, $y^2 = 3ax$, and $y^2 = 4a^2 - x^2$.

4. Find the volume generated by the revolution about the axis of x , of the curve $y^2 = a^2 x^2 (x^2 - a^2)$.

5. Find the length of the line joining the centre of gravity of a quadrant with the centre of the circle.

6. Deduce the equation to the loxodromic curve.

7. A body is projected vertically upward from the top of a tower 80 feet in height with a velocity of 96 feet per second; in what time will it strike the ground?

8. Show that the maximum range on an inclined plane of a projectile having a given initial velocity, u , is $\frac{u^2}{g} \left[\frac{1 - \sin \beta}{\cos^2 \beta} \right]$, in which β denotes the inclination of the plane to the horizon.

9. A ball is projected from a point on a smooth billiard-table and after striking the four sides in order returns to the starting point; show that the sides of the parallelogram described are parallel to the diagonals of the table, the elasticity being perfect.

10. At what elevation must a shot be fired with a velocity of 400 feet that it may range 2500 yards on a plane which descends at an angle of 30° ?

11. If a clock loses 30 seconds in 12 hours, by what proportional part of itself must the pendulum be shortened?

12. A chain cable 120 fathoms long fills up 8' of a chain-locker, the bottom of which is 25' below the main deck on which the chain is to be roused up; how much of the work is done when there are 60 fathoms on deck?

13. Find the centre of pressure of an immersed triangle of altitude h and base b ; the base being parallel to the surface, and the apex being between the base and the surface and at a distance a below it.

14. A balloon, when released from the ground, rises with a vertical acceleration of 32' per second, but when 200 pounds of ballast are thrown out, the acceleration is increased to 36' per second; the weight of a cubic foot of air is 527.04 grains, and the specific gravity of the gas in the balloon, as compared with air, is 0.4; what is the volume of the gas in the balloon [the air displaced by the car and attachments being neglected]?

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN-QUESTIONS.

Translate :

C'est à Francfort que j'appris à connaître la vie militaire. Jusque-là je n'avais été qu'un simple conscrit, alors je deviens un soldat, et je ne parle pas ici de l'exercice, non! La manière de faire tête droite et tête gauche, d'emboîter le pas, de lever la main à la hauteur de la première ou de la deuxième capucine pour charger le fusil, d'ajuster, et

de relever l'arme au commandement, c'est l'affaire d'un ou deux mois avec de la bon volonté. Mais j'appris la discipline, à savoir ; que le caporal a raison lorsqu'il parle au soldat, le sergent lorsqu'il parle au caporal, le sergent-major lorsqu'il parle au sergent, le sous-lieutenant au sergent-major, ainsi de suite jusqu'au maréchal France—quand ils diraient que deux et deux font cinq ou que la lune brille en pl midi.

Cela vous entre difficilement dans la tête, mais quelque chose vous aide beaucoup c'est une espèce de pancarte affichée dans les chambrées, et qu'on vous lit de temps en temps, pour vous ouvrir les idées. Cette pancarte suppose tout ce qu'un soldat peut avoir envie de faire, par exemple de retourner dans son village, de refuser le service de résister à son chef, etc., et cela finit toujours par la mort ou cinq ans de boulot moins.

Le lendemain de notre arrivée à Francfort, j'écrivis à M. Goulden, à Catherine et la tante Grédel ; on peut se figurer avec quel attendrissement. Il me semblait, en parlant, être encore au milieu d'eux ; je leur racontais mes fatigues, le bien qu'il m'avait fait à Mayence, le courage qu'il m'avait fallu pour ne pas rester en arrière. Je leur dis aussi que j'étais toujours en bonne santé, grâce à Dieu ; que je me sentais plus fort qu'avant de partir, et que je les embrassais mille et mille fois.

ORAL EXAMINATION.

1. Explain the rules of contraction in French, with examples.
2. Explain the rules of elision, with examples.
3. Explain the use of the partitive articles.
4. How many conjugations are there in French ?
5. How are they distinguished from each other ?
6. How many simple tenses are there ?
7. Name the primitive tenses.
8. Is there any difference between *tromper* and *se tromper* ?
9. Explain the meaning of the expression *s'en aller* ?
10. When do past participles vary ?
11. Define a unipersonal verb, and give examples.
12. Explain the use of the imperfect and past definite tenses.
13. Explain how compound nouns are pluralized.
14. Is the verb *faire* used in an idiomatic sense ? If so, give an example under each case.
15. Is *mettre* or *se mettre* used idiomatically ? Give an example under each head.
16. Give the ordinal numbers as far as fifty.
17. What verb is used in speaking of age ?
18. In speaking of a person's health, what verb is used ?
19. Explain the use of the subjunctive mood.

Nautical phrases. *Translate into English :*

1. "Tout le monde en haut pour diminuer de voiles."
2. Sur la perpendiculaire de notre route.
3. L'équipage sait bien faire les exercices.
4. "Haut la main, hardi."
5. Entre deux eaux.
6. "Brassez légèrement sous le vent."
7. Un coup de vent emporta notre misaine.
8. Dégagez ce palan.
9. Veillez le sillomètre.
10. Il nous lâcha une bordée en passant.
11. Ho, de la hune de misaine.
12. Pres et plein.

13. Bordez les écoutés tout plat.
14. L'amiral porte le pavillon au grand mât.
15. Courir babord au vent.
16. On arme une escadre à Brooklyn.
17. Amarez partout. Lof tout.
18. C'est l'heure de la haute marée.
19. Tapez les canons. Avant tribord.
20. Armez ce canot. Accostez, patron.

Translated into English extempore :

Après avoir servi dix-sept ans sous différents généraux, Turenne fut fait maréchal de France à 32 ans. Rien ne lui faisait plus d'honneur que l'aveu de ce qu'il croyait devoir à chacun de ses maîtres. Il disait, "qu'il tenait du prince Frédéric-Henri d'Orange, son oncle, les principes de bien choisir un camp, d'attaquer une place dans toutes les règles, de former un projet, de le rouler longtemps dans la tête, et de ne rien faire paraître qu'au moment de l'exécution; d'être dépouillé d'ostentation, et de se remplir de sentiments vifs et relevés pour l'intérêt de la patrie plutôt que pour sa propre gloire." En parlant du duc de Weimar, il disait "que de rien ce général faisait toutes choses et ne s'en orgueillissait pas de ses succès; que, lorsqu'il avait du malheur, il ne songeait pas tant à se plaindre qu'à se relever; qu'il aimait mieux se laisser blâmer injustement que de s'excuser au dépens de ses amis qui avaient manqué dans l'action; qu'il était plus occupé à réparer ses fautes qu'à perdre son temps en apologies; et, enfin, qu'il cherchait plus à se faire aimer par les soldats, qu'à s'en faire craindre." Il avait remarqué sous le cardinal de La Valette, "que, pour être agréable aux militaires, il fallait, en allant à l'armée, renoncer aux fausses délicatesses de la cour, à la galanterie, aux amusements du bel esprit, et vivre avec les officiers à leur mode, sans façon et sans affectation. Il fut confirmé, en voyant la conduite du comte d'Harcour, dans la grande maxime de César, que de toutes les vertus militaires, la diligence et l'expédition sont les plus essentielles, et qu'elles entraînent ordinairement les succès quand elles sont accompagnées de circonspection et de prudence."

Conversation, entirely in French.

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, MAY, 1874.

I.

1. Make preparations for loosing sails to a bowline, topgallant and royal yards across.
 2. Ship under courses, topsails, topgallant-sails, jib, and spanker: tack ship.
 3. Set a mainsail; moderate weather; wind on the quarter.
 4. Carry out a stream-anchor.
 5. Haul down and stow the jib; strong breeze.
 6. What lights must ships at anchor show? What lights do pilot-vessels carry?
 7. Define an ebb-tide.
-
1. Riding to a windward tide, wind aft, get under way and stand out before the wind.
 2. Hove to, with main-topsail aback; fill away.
 3. Take in all the starboard studding-sails.
 4. Hoist in guns through a gun-deck port.
 5. Set mainsail; fresh wind; yards braced up.
 6. How does a ship, trimmed by the head, carry her helm?
 7. Define a spring-tide.

III.

1. Make all preparations for weighing anchor.
2. Ship under all drawing sail, wind aft, man falls overboard : what should be done ?
3. Set a jib ; fresh wind.
4. Weather topsail-sheet and clewline carried away : what is to be done ?
5. Set a mainsail ; wind fresh on the quarter.
6. Make a diagram of two vessels, A and B : A sees a green light and a top light (tricolor) points forward of the port beam ; what is each vessel to do ?
7. In getting under way, how would you cast, in reference to danger ?

IV.

1. Furl sails; topgallant and royal yards in the rigging; sails loosed to a bowline.
2. Wear ship in a very light breeze.
3. Take in a mainsail; moderate weather; yards braced up.
4. Put on a mooring-swivel.
5. Set a jib; fresh breeze.
6. Two sailing-ships crossing so as to involve risk of collision; what is the duty of each?
7. Define a flood-tide.

v.

1. Riding to an ebb-tide; wind abeam; get under way and stand out.
2. Ship lying becalmed; head-yards abox by starboard braces; breeze striking on starboard bow; what is to be done?
3. Set all the starboard studding-sails.
4. Stow a sheet-anchor.
5. Take in mainsail; fresh wind; yards braced up.
6. Ship comes to against the helm; box her off.
- 7.

VI.

1. Unbend sails; topgallant and royal yards in the rigging.
2. Wear ship in a moderate or fresh breeze.
3. Take in a mainsail; fresh wind; yards braced up.
4. Moor ship, riding to single anchor, in a tide-way.
5. Set topgallant-sails; moderate weather; on a wind.
6. Two steamships meeting end on, or nearly so, so as to involve risk of collision what is the duty of each?
7. How is it known when a ship is *full and by* in a light breeze? in a strong breeze?

VII.

1. Under all starboard studding-sails, run in and anchor (no tide).
2. By the wind, heave-to, to speak a vessel.
3. Take in the topsails; blowing fresh; yards braced up.
4. Square yards.
5. Set a lower studding-sail.
6. With plenty of sea-room, wind fair, under what sail would you get a ship under way?
7. Define a windward ebb-tide.

VIII.

1. Loose sails to a bowline, in port, at color-hoisting; topgallant and royal yards across.
2. Tack ship under all plain sail in a very light breeze.
3. Set a mainsail; fresh wind; yards braced up.
4. Carry out a bower-anchor with a launch.
5. Take in all the port studding-sails.
6. What lights do fishing-vessels carry? What fog-signal is used in steamships and sailing-ships, respectively?
7. In bracing up yards, studding-sails set, what gear must be tended?

IX.

1. Ship moored in a tide-way, starboard-anchor up stream, port-anchor down stream, riding to the ebb-tide, with an elbow in the hawse; make all preparations and clear hawse.
2. Under all plain sail, by the wind, struck by a squall; what is to be done?
3. Set and take in royals and flying-jib.
4. Weather foretopsail reef-tackle carries away while reefing; what must be done?
5. Take in a mainsail; blowing fresh; yards braced up.
6. Make a diagram of two vessels, A and B: A sees a green light and a top light three points on port bow; what is each vessel to do?
7. What sail ought a ship usually to carry in coming to an anchor?

X.

1. Make preparations for bending topsails, courses, jib, and spanker.
2. Box-haul a ship.
3. Lying to in a gale, take in a close-reefed maintopsail.
4. By the wind, under all plain sail, wind shifts to the quarter; what is to be done?
5. Set a mainsail; fresh wind; yards braced up.
6. Make a diagram of two vessels, A and B: A sees a red, a green, and a top light, and B sees a red and a green light; what are the duties of each vessel?
7. Trim yards; wind abeam.

DEPARTMENT OF ORDNANCE AND GUNNERY.
FABRICATION OF GUNS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, four hours.*

1. Describe the Parrott gun and the method of re-enforcing it.
2. Describe the Armstrong gun and the method of fabrication; leading features; its advantages and defects.
3. Describe the present rifled muzzle-loading gun of the British service.
4. What is the method of re-enforcing guns by hoops with *initial tension*? What by hoops with varying elasticity?
5. What are the advantages and disadvantages of cast-iron guns?
6. What are the benefits arising from hollow castings?
7. Describe the advantages and the disadvantages of wrought iron for guns; strength; uniformity; detection of weakness (in built-up guns); resistance to wear; want of homogeneity; welds; cost.
8. What is the object of rifling? Define and explain the leading systems.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.
NAVIGATION.

MONTHLY EXAMINATION.

DECEMBER 30, 1873.—*Time allowed, four hours.*

1. What is latitude? Deduce the formulas for finding the latitude by a single altitude of a heavenly body off the meridian, the longitude and Greenwich mean time being given. Explain how ϕ'' and ϕ' are marked. When does this method fail at sea?
2. Deduce the formula (ver sin) for finding the latitude by a single altitude of a heavenly body observed near the meridian, the latitude being approximately known, and the longitude and Greenwich time being given. Explain how in this problem the

hour-angle of the sun is found in practice. When the resulting latitude differs widely from that by *dead reckoning*, how would you proceed? Why is the above method ever used in preference to that by ϕ'' , &c.? Give the reasons at length.

3. Deduce the formula by which is computed the change in altitude of a heavenly body in one minute from its culmination, its declination and the latitude being given. Why is Bowditch's Table XXXII, which is computed by this formula, left blank when $(L-d) < 4^\circ$? How do altitudes vary near the meridian?

4. Deduce the formula (Chauvenet's) for finding the latitude by two altitudes of a heavenly body, observed near the meridian, the hour-angle being unknown, but the elapsed time given. What advantage does this method possess over the ϕ'' method? How is this method limited?

5. Deduce the formula given in Coffin's Navigation for finding the latitude by an observed altitude of the star Polaris. How do you find t in this method? When is $L = h + \phi$? When is $L = h - \phi$? Why is Bowditch's pole-star table now incorrect?

PRACTICAL WORK.

1. December 30, 1873, a. m. Longitude 139° E. Eye, 18 feet above the water. Index-correction of the sextant $-2' 00''$. Gr. chro. time, obs. $3^h 05^m 15^s$; the chro. cor. being $+2^m 1^s$. * Sirius, obs. alt. $45^\circ 52' 00''$, bearing southerly. Required the latitude by the ϕ'' , &c., formulas.

2. December 30, 1873. Lat. D. R. $27^\circ 40'$ N. Long. D. R. 140° W. Gr. chro. time, obs. $9^h 1^m 40^s$, $\odot$ obs. $3^\circ 44' 10''$. Gr. chro. time, obs. $9^h 32^m 16^s$, $\odot$ obs. $3^\circ 38' 30''$. Eye, 18 feet above water; index-cor., $-2' 00''$; chro. cor., $+4^m 11^s$; and daily rate gaining $0^s 3$. Required the latitude by the formula, $h_0 = \frac{1}{2}(h + h'') + \&c.$

3. December 30, 1873. Local mean time, $\approx 20^m$ a. m.; long., $\approx 1^\circ$ E.; eye, 18 feet above water; index-cor., $-2' 00''$; obs. alt. of * Polaris $3^\circ 22' 10''$. Required the latitude.

THEORY OF NAVIGATION.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, five hours.

1. Find the rigorous expression for the difference of longitude made by a ship which sails from the equator on a given course, C , until she arrives in a given latitude, L .

2. Deduce the formula for finding the amplitude of a heavenly body when in the horizon of a given place. State how amplitude is named.

Deduce the formula for finding the hour-angle of a heavenly body when on the prime vertical, east; the latitude being of the same name as the body's declination, and numerically greater.

Define the *equation of equal altitudes*. What is the necessity for its use?

3. Deduce the formulas for finding the latitude from an altitude of a heavenly body observed at any time, the local time of the observation and the longitude of the place being given. When are observations by this method, for latitude, too inaccurate for use at sea?

Simplify the formulas for use when the star Polaris is observed.

4. Deduce the formula for finding the latitude by two altitudes of the sun observed near noon, the local time being unknown, but when you have a Greenwich chronometer at hand whose error is approximately known.

5. Deduce the formulas for finding, at a given place, the astronomical bearing of a terrestrial object, when the angle between the terrestrial and celestial bodies is measured with a sextant, and the local mean time known.

6. Describe fully the principles of Sumner's method of finding a ship's position at sea. When the ship has moved between the observations, how do you determine the latitude and longitude at the time of the second observation?

What special use is made of a single line of position? How may the azimuth of a heavenly body be found by means of this single line?

7. Describe fully the method of swinging a ship in a harbor, when a distant land mark is visible, for the purpose of determining the deviation of her compass. How is the amount of deviation found for each point of the compass?

PRACTICE OF NAVIGATION.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, eight hours.

1. Day's work :

(a) On May 29, 1873, at 2 p. m., took a departure, Cape Henry light, in lat. $36^{\circ} 55' 30''$ N.; long. $76^{\circ} 00' 12''$ W., distant twelve miles, bearing, per compass, W. by N. (the ship's head being east, and the deviation on that point $\frac{1}{4}$ point easterly). Variation from the chart, one point westerly. Thence sailed the following courses, &c. :

Distance.		Compass courses.	Direction of wind.	Lee-way.	Deviation.
Kts.	Fms.				
15	0	N. $\frac{1}{2}$ E	Southward and eastward....	$\frac{1}{4}$ point...	$1\frac{1}{2}$ points easterly.
25	6	E. $\frac{1}{2}$ N	do	do	$\frac{1}{4}$ point easterly.
32	0	E by N	do	do	$\frac{1}{4}$ point easterly.
12	0	W. by N	Southward and westward....	do	2 points westerly.
19	2	S. $\frac{1}{2}$ W	do	do	$1\frac{1}{2}$ points westerly.
*15	4	S. by W	do	do	$1\frac{1}{2}$ points westerly.

* Run to noon from a. m. sight.

NOTE.—Work to the nearest quarter of a point.

(b) At noon, May 30, 1873, observed the merid. alt. $\odot 75^{\circ} 14'$, bearing south; eye, 18 feet above the water; index-cor., $-2' 10''$.

(c) About 8 a. m., May 30, 1873, observed the altitude $\odot$, $36^{\circ} 20' 40''$, eye 18 feet above the water; index-cor., $-2' 10''$; watch-time of obs., $7^h 57^m 30^s$; chro. — watch, $5^h 00^m 15^s$; and the chro. cor., $+2^m 45^s$. At the same time the $\odot$'s bearing, per compass, was N. $116^{\circ} 30'$ E., the ship's head being S. by W., and the deviation on that heading $1\frac{1}{2}$ points westerly.

Give for noon, May 30, 1873, the following :

Latitude by dead reckoning.

Longitude by dead reckoning.

Latitude by observation.

Longitude by observation.

Variation of compass, per azimuth, at 8 a. m.

Course made good.

Distance made good.

Current (amount and direction of).

2. Equal altitudes of the sun's lower limb, with a sextant and artificial horizon, a. m. and p. m.

June 1, 1873.—Lat., $30^{\circ} 20'$ S.; long., $170^{\circ} 00' 00''$ E.A. M., watch-time of obs., $10^h 00^m 50^s$; 2 obs., alt. $\odot$, $70^{\circ} 00' 00''$.P. M., watch-time of obs., $1^h 39^m 50^s$; 2 obs., alt. $\odot$, $70^{\circ} 00' 00''$.

Comparisons.

Before going on shore :

	<i>h</i>	<i>m</i>	<i>s</i>
Chro	4	10	10
Watch	9	20	30

On returning to the ship after the second observation :

Chro	9	28	52
Watch	2	39	20

Required the error of the chronometer on Greenwich mean time.

3. Astronomical bearing.

May 30, 1873, a. m.—Lat., $30^{\circ} 50'$ S.; long., $4^h 30^m 20'$ W.Watch-time of observation $3^h 52^m 52^s$

At this time measured the angle, with a theodolite, between a light-house and sun's nearest limb, $12^{\circ} 14' 34''$; the sun being to the right of the light-house.

Required the sun's *true* altitude, and the *true* bearing of the light-house.

4. *Meridian-altitude of the moon.*

May 7, 1873.—Observed the merid. alt. $\underline{D}$ $78^{\circ} 23' 40''$, bearing south. Long., 79° W. Index-cor., $+ 2' 00''$. Eye, 18 feet above the water. Required the latitude.

5. Find the time of high water on June 1, 1873, a. m., at Typa Roads, Canton Rh in latitude north, and long. $113^{\circ} 14' E.$, the *corrected establishment* being $10^h 00^m 00^s$.

Which will be the higher tide, this one, or the p. m. tide of the same day?

6. *Finding the error of a chronometer by the transit instrument.*

October 13, 1873, at Annapolis, Md., lat. $38^{\circ} 58' 53'' N.$, long. $5^h 5^m 57^s.5 W.$, the *real* clock-time of the transit of the star α *Aquila* over the—

	<i>h</i>	<i>m</i>	<i>s</i>
1st wire was	19	00	0
2d wire was	19	00	2
3d wire was	19	00	3
4th wire was	19	00	4
5th wire was	19	00	5
The sidereal clock had no rate.			
The comparison was: Sidereal clock	19	02	1
Chronometer	5	55	3

Required, (1) the error of the sidereal clock on local sidereal time; (2) the error of chronometer on local mean time.

7. Find the *great-circle* course and distance, by computation, from—

Lat. $37^{\circ} 02' S.$ } to { Lat. $6^{\circ} 47' S.$
Long. $12^{\circ} 17' W.$ } { Long. $105^{\circ} 13' E.$

Also find, by *inspection*, the Mercator's course and distance between the same t places.

8. *Latitude by the Pole Star.*

December 22, 1873, at local mean time, $5^h 55^m$ p. m., in longitude $162^{\circ} W.$, observe the altitude of star Polaris, $79^{\circ} 10'$; eye, 18 feet above the water; index-cor., $+ 2' 0$ Required the latitude.

9. *Latitude by an altitude of the sun taken near noon (rer-sin method).*

November 14, 1873.—Approximate latitude, $31^{\circ} 15' S.$; long., $90^{\circ} 20' W.$ Watch-time of obs., $11^h 40^m 30^s$; chronometer — watch, $6^h 03^m 03^s$; chro. cor., — $12^m 20^s$; eye, 18 f above the water; index-cor., — $3' 10''$; and the obs. alt. $\odot$ $76^{\circ} 04' 15''$, the sun bearing northerly. What was the latitude?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—Time allowed, five hours.

1. How may the co-efficient of absolute expansion of mercury be determined? Give the formula for finding the temperature by the weight-thermometer.

2. What is the corrected reading of a barometer that stands at 755^{mm} at $15^{\circ} C.$, calling the co-efficient of expansion of mercury $\frac{1}{55558}$? What is the temperature of water at its maximum density, and of what importance is this in the economy of nature?

3. Describe Regnault's method of determining the co-efficient of expansion of air.

4. A cubic decimeter of air weighs 1.205 grammes at $20^{\circ} C.$; what will be the weight of the same volume at 10° ? What is the tension of the vapors of mixed liquids? What is meant by "the retardation of the point of solidification"? Give some illustrations.

5. What is the cause of the reduction of temperature by freezing-mixtures, such as—

sulphate of sodium with hydrochloric acid and common salt with snow? How may mercury be artificially frozen and alcohol reduced to a viscous state?

6. What five gases have not been liquefied? What is the weight of a volume of air saturated with aqueous vapors at a temperature of 12° C. and pressure of 755^{mm}? (A cubic inch of dry air at 0° C. weighs 0.31 grains, and the density of aqueous vapor is 1.625 as compared with air.)

7. What are the laws regulating the intensity of radiant heat? What becomes of all the heat falling upon the surface of any body? Explain why the specific heat of gases under constant pressure is different from the specific heat under constant volume, and deduce the formula expressing their ratio.

8. If the total length of the steel bars of a gridiron-pendulum be 50 centimeters, how long must the brass rods be that the pendulum may not change its length with change of temperature? (The co-efficient of expansion of steel is 0.0000123; of brass, 0.000187.) Compute the amount of heat imparted to a room by 15 pounds of steam entering at 100° C., and flowing off condensed to water of 98° C.

9. What is the mechanical equivalent of heat? How has it been determined experimentally by Joule and theoretically by Mayer and Tyndall?

10. If the heat necessary to convert 50 pounds of ice into steam at 100° C. could be applied without loss to lifting the mass of ice, how high would it be raised? If a ball of iron weighing 150 pounds strike a target with a velocity of 1,200 feet per second, and the motion of the mass be converted into molecular motion, of which the ball takes up one-fourth, through how many degrees of temperature, centigrade, will the ball be raised? Specific heat of iron, 0.115.

11. Explain the formation of clouds. During the summer months, in the bay of Bengal, a vessel will probably find a SW monsoon instead of the trade-wind. What is the cause of this phenomenon?

12. How is the wet-bulb hygrometer employed to determine the hygrometric state? Explain the formation of the primary and the secondary rainbow.

LIGHT.

MONTHLY EXAMINATION.

FEBRUARY 24, 1874.—*Time allowed, two hours.*

1. Deduce the formula for determining the conjugate foci of concave mirrors. Show what change is necessary to adapt this to convex mirrors.

2. Find the deviation of the prism whose refracting-angle is A in terms of the angles of incidence and emergence; also, show how the index of refraction of such a prism may be determined from the deviation.

3. Deduce the formula for the double-convex lens—

$$\frac{1}{p} + \frac{1}{p'} = \frac{1}{f}.$$

4. Show that the intensity of the illumination of a plane surface is proportional to the cosine of the angle of incidence of the rays. It is found by means of Bunsen's photometer that the intensity of illumination of a certain gas-burner, placed at the distance of 25 feet from the screen, is equal to that of a standard candle placed 4 feet from the screen. Compare the intensities of the two lights.

Take any two of the four following:

5. A small plate is fixed on the floor of a room 9 feet distant from the wall; at what height on the wall must a bracket gas-burner projecting 1 foot be placed, that the plate may receive the greatest possible direct illumination?

6. What must be the least length and the position of a plane mirror fixed against the vertical wall of a room in order that a man whose height is 6 feet may see his entire figure at one view? Would a shorter mirror serve the same purpose if inclined against the wall?

7. Show that a man looking in a mirror can place his finger in such a position upon that, upon closing either eye, he will see only the open one.

8. Let A and B be two media separated by a plane surface; let v be the velocity of light in A , and v' that in B ; show that, if CDE be the path of the ray which occupies the least possible time in passing between any two fixed points, C and E , the ratio of the sines of the angles of incidence and refraction at D will be constant.

LIGHT.

ANNUAL EXAMINATION.

MAY, 1874.—Time allowed, four hours; any two questions may be omitted.

1. Prove that in the case of a concave mirror—

$$\frac{\text{length of the object}}{\text{length of the image}} = \frac{\text{distance of the object from the principal focus}}{\text{focal length}}$$

2. Define the *critical angle* of a substance, and determine its measure. What is the greatest apparent zenith-distance which a star can have as seen by an eye below the surface of water, the index of refraction between air and water being $\frac{4}{3}$?

3. Deduce directly the formula for conjugate focal distances in the case of a convex lens.

4. A convex lens held 12 inches from a wall forms on it a distinct image of a candle; when the lens is held 6 inches from the wall, it is found that to produce a distinct image of the candle its distance from the lens must be doubled; find the focal length of the lens.

5. Define the *optical centre* and the *secondary axes* of a lens. Prove that every ray whose direction is unchanged by traversing a lens passes through the optical centre.

6. Show that in the case of a convex lens—

$$\frac{\text{length of the object}}{\text{length of the image}} = \frac{p-f}{f},$$

p denoting the distance of the object from the optical centre.

7. A person has 6 inches for his nearest limit of distinct vision; what kind of glasses must he wear, and of what focal length?

8. Draw a horizontal section of a spectroscope through the axes of the tubes. State the positions and uses of the important parts.

9. How is the presence of dark lines in the solar spectrum explained? Define the dispersive power of a prism, and deduce the algebraic expression for it.

10. Apply the principles of the undulatory theory of light to the case of reflection from a plane surface. In what respect do the vibrations of elliptically-polarized light differ from those of common light, and the latter from those of plane-polarized light?

11. How does the Newtonian differ from the undulatory theory of light in its explanation of the phenomena of refraction? How was the former disproved by Foucault's experiments?

12. Explain carefully how a particular wave-length may be determined by means of the diffraction-spectrum.

13. How may light be polarized by reflection? How is the extraordinary index of refraction defined?

14. Prove that, if in a homogeneous medium the force tending to restore a displaced particle to its original position of equilibrium is proportional to the displacement, the particle will describe an ellipse about that point as a centre.

DEPARTMENT OF STEAM-ENGINEERY.

STEAM.

ANNUAL EXAMINATION.

MAY 25, 1874.—Time allowed, five hours.

I.

Sketch and describe the common (siphon) mercurial pressure-gauge, as applied to boilers and condensers, and the Bourdon pressure-gauge. Explain their several principles of action.

II.

What is the greatest pressure per square inch (by gauge) that may be employed in a cylindrical boiler 8 feet in diameter and 8 feet in length, made of iron plates of $\frac{1}{4}$ inch in thickness. Data: ultimate resistance of metal per square inch of section, 54000 pounds; factor of safety, 6; seams, double-riveted.

III.

Calculate the horse-power from the following data: Mean pressure upon piston, 42.325 pounds per square inch (absolute); back pressure upon piston, 4.00 pounds per square inch (absolute); diameter of piston, 50"; stroke of piston, 42"; revolutions of engine, 60 per minute. Give also the boiler-pressure from the above data, the rate of expansion being 2, and the hyp. log. of 2 = 0.693.

IV.

Give the quantity of water, in pounds, that will be required to condense the steam discharged from a pair of cylinders of 50 inches diameter, and 42 inches stroke of piston, according to the following data: Revolutions of engine, 60 per minute; rate of expansion, 2; mean pressure, 42.325 pounds; hyp. log., 2=0.693; temp. of hot-well, 130° Fah.; temp. of injection-water, 60° Fah.; total heat, 1197°; latent heat, 916° weight of one cubic foot of steam, $\frac{12.3}{1700}$ pounds.

V.

Give the loss incurred by the practice of "blowing off" according to the data of question IV; the concentration of the sea-water being $\frac{13}{32}$, by hydrometer, at 200° Fah., and the condenser a jet-condenser. Describe the means of ascertaining the concentration of water in marine-boilers, and the results of concentration when excessive; state why they should be averted.

VI.

Give the maximum speed that will enable a vessel to steam 1777 $\frac{1}{2}$ miles according to the following data: maximum speed of vessel at full power, 10 knots; consumption per day at that speed, 50 tons; coal on board, 300 tons; state also the quantity that will be consumed daily.

VII.

Sketch and describe a balanced (poppet) steam and exhaust valve; also some form of slide-valve, explaining the meaning of the terms *lap*, *lead*, and *cut-off*.

Sketch some form of independent expansion-valve.

VIII.

A steamer makes 10 knots (of 6086 feet) per hour; what is the slip according to the following data? Revolutions of screw per minute, 50; pitch of screw, 24 feet.

IX.

Sketch an indicator-diagram, and describe its uses.

X.

Describe a surface-condenser, stating in what respect it differs from the jet-condenser, and why it is generally preferred for marine-service.

DEPARTMENT OF ENGLISH STUDIES, HISTORY AND
LAW.

LAW.

ANNUAL EXAMINATION.

MAY 21, 1874.—*Time allowed, five hours.*

[* Starred questions are alternatives.]

CONSTITUTION OF THE UNITED STATES.

I.

Describe the process by which a bill becomes a law.

With whom rests the power of impeachment? the power of trying impeachments? the power of trying cases of admiralty jurisdiction? of determining the rules of proceedings in either House of Congress? of originating bills for raising revenue? of defining and punishing offenses against the Law of Nations? of appointing consuls? of admitting new states into the Union? of declaring what officer shall act as President in case of the disability of both the President and Vice-President?

II.

State the provision of the Constitution with regard to (1) export-duties; (2) tonnage-duties; (3) unreasonable searches and general warrants; (4) religious tests.

What is said to be the supreme law of the land?

Give the substance of the XIII. Amendment; of the XV. Amendment.

Power to grant letters of marque and reprisal: to whom given? from whom withheld?

INTERNATIONAL AND MARITIME LAW.

III.

Describe the process by which International Law came into its present form, and show upon what basis it rests.

What is the objection to the word *law* as applied to the principles governing the relations of states? How can the use of the word be justified?

What are the sanctions of International Law?

III*.

Describe fully, (1) Municipal Law; (2) Civil Law; (3) Common Law; (4) Statute-Law; (5) Constitutional Law.

Discuss Kent's analysis of the elements of International Law.

IV.

1. The immunities of ambassadors as to (a) persons; (b) places.
2. The immunities and judicial power of consuls.
3. In a defensive alliance, when can the *casus faderis* apply to a war offensive in its operations?
4. What is the objection to the transfer of property *in transitu* during war?
5. State the circumstances and discuss the bearings of the Silesian Loan case.

IV*.

State in full the law as to the confiscation of enemy's property and debts found in the country on the breaking out of a war. Apply it to the following cases, showing in each case the principles on which the law rests:—

1. Enemy's public property.
2. Enemy's private property.
3. Debts due the enemy.

4. Stocks held by the enemy.

5. Government bonds held by the enemy.

What exception to the law was made by England in the Crimean War ?

V.

1. Define blockade.

2. In what two ways may a neutral have notice of the existence of a blockade ?

3. How does this affect the question of the neutral's guilt in sailing for a blockaded port ?

4. How is the act of sailing for such a port considered ?

5. How long do the offense and liability of a ship breaking a blockade continue ?

6. In prize-cases, when are damages awarded against the captor ?

V*.

State in full the distinction drawn as to freight, ship, and cargo in adjudging upon a neutral the penalty for—

1. Carrying enemy's property (before 1856).

2. Breach of blockade.

3. Carrying contraband.

4. Rescue of prize.

5. Carrying enemy's dispatches.

6. Resistance to the right of search.

VI.

Explain fully any five of the following :—

1. Bottomry-bonds.

2. Registry, enrollment, and license.

3. General average.

4. Bill of lading.

5. Stoppage *in transitu*.

6. Domicile.

7. Postliminy.

8. Rule of 1756.

VII.

1. State in full the reasons for and against the rule subjecting property at sea to capture and confiscation during war.

2. What must be the nationality of a prize-court, and where can it sit ?

3. Has a prize-court jurisdiction over prizes in neutral ports ?

4. How is a license to trade regarded by cruisers of the government granting it ? by cruisers of an ally ? by cruisers of the enemy ?

5. State the provisions of the declaration of the Congress of Paris in 1856.

VII*.

1. Name the ship's papers required both by International and Municipal Law, and describe charter-party, clearance, shipping-articles, and sea-letter.

2. State the circumstances connected with the capture of the Florida in Bahia, and show fully the bearing of the law on the case, and on the relations of the governments concerned.

3. What must be done with captures made after a treaty of peace ?

4. If one party to a treaty violates it, is the treaty void ?

VIII.

In the case of a war between the United States and France, in command of the United States steamer Constellation, cruising in the West Indies, you recapture an American brig, having on board a prize-crew from her captor, the Insurgente, and bound to Mar-

tinique for adjudication. Describe all the consequences of the recapture, stating what you do with the prize, and what becomes of her finally; in general, show how all parties are concerned, giving reasons.

Some days after, you capture a brig owned in Bahia, and engaged in carrying contraband to France. She is taken into port and condemned on that ground. It appears that she was originally an American vessel, but was captured early in the war by the French, condemned as enemy's property, and sold to a Brazilian firm. The original owner puts in a claim. How is it to be decided?

IX.

Next day you search a Dutch (neutral) brig, bound from Guadeloupe to Copenhagen. You discover a packet addressed to the French ambassador at Copenhagen, from the governor of the island. The master does not voluntarily disclose the packet, nor does he practice any fraud. What would you do? What consequences would flow from your act?

Later, you speak a vessel, flying the Swedish (neutral) flag, about 14 miles out of Kingston. You attempt to search her, but only succeed by overcoming a forcible resistance. On examination, you find that she is a French merchantman, having on board cargo partly French and partly neutral. You find that her condition is such that extensive repairs will be necessary before she can make a long voyage. What is to be done, and what results flow from your action?

X.

Later, you search a barque sailing from Rio to Havana, under Spanish colors. You find that the owner is a Frenchman, who has resided for the last three years in Havana. What would you do? Supposing that you captured the vessel and sent her in, what would be the decision of the court?

Next day, you fall in with two vessels, both American, and trading between New York and Martinique; one, a brig, under a license from the French government; the other, a barque, under a license from the Department of State of the United States. What would you do?

Later, you find a third vessel, a neutral, licensed like the last, bound for Martinique from Halifax, having on board artillery-saddles and uniforms, which the owner of the ship is sending as a part of the cargo, along with other merchandise belonging to himself and to other parties.

Consequences?

DEPARTMENT OF MODERN LANGUAGES.

SPANISH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN QUESTIONS.

Translate into Spanish:

They do what they can, but not what they wish.

What is the matter with you?

I have a sore arm and cannot work.

But you can write, can you not?

No, sir; because I cannot raise my arm.

Can your children write and read?

The elder can read a little.

What is there new this morning?

I do not know; I have not been out yet.

At what hour shall I go out?

A little later, between nine and ten o'clock.

If you had money, would you lend me some?

No, because you are a great spendthrift.

I would be able to pay you to-morrow evening.

Which do you like most, tea or coffee?

Waiter, bring three glasses of wine and two of tea.

Will you be here at our house Wednesday morning?

Remain at home until my return.

I have to go to market at ten o'clock.

It will not be necessary to go there to-day.

Why do you not take off your hat when I enter?

I was studying, sir, and did not see you.

Conjugate the verb *ser* in all moods and tenses.

Translate the following verbs, and give their past participles: *abrir, morir, ver, poner, hacer, decir, escribir*.

How are English nouns ending in *ty* or *dy* usually rendered in Spanish?

Define an impersonal verb, and give an example.

Give the cardinal numbers from one to twelve.

What is a reflexive verb?

How many conjugations are there, and how are they distinguished?

Translate into English:

I.

Querido amigo:

Temes que estoy necesitado, y quieres dividir conmigo lo poco que tienes! Mereces que te levantar estatuas, y si fuera este el tiempo de la gentilidad tú serias adorado como á Dios de la amistad. Es triste verse en necesidad, pero es muy consolante encontrar almas tan tiernas y tan grandes como la tuya que la compadezcan. Y quieres ahora forzar mi gratitud al silencio?

Esto no puede ser, amigo mio. Permite pues que te diga que mi gratitud será pura y mi afecto eterno. Envíame la mitad de lo que me ofreces, y esto será bastante para hacer muy rico á tu pobre amigo.

II.

Queridos discípulos y amigos:

El jefe del departamento y los instructores en el ramo de Español, que comprenden cuan feliz es el momento en que un estudiante recibe su diploma, se adelantan hoy á congratular tanto á vosotros como á vuestras familias por el cercano evento, y se complacen en declarar que vuestra conducta ha sido digna de los que reciban el noble título de oficiales de la marina americana. Pero como nuestras relaciones van á cesar, permitidnos algunas reflexiones que el interes por vuestro porvenir nos inspira.

Refrescad de tiempo en tiempo con vuestros libros las ideas adquiridas, y veréis que la teoria toma formas y se da la mano con la practica, y por lo que toca á los lenguages no olvideis que lo mas necesario es usar desde luego lo que ya sabeis.

Muchos son los puertos en donde el idioma español se habla, en todos ellos encontraréis admiradores, sea de vuestras instituciones, sea de las gracias que acompañan siempre á la juventud. Convencidos de esto no tengais miedo del ridículo al hablar el Español. Los nativos estarán contentísimos de interpretar vuestros pensamientos y os ayudarán en vuestras dificultades. Hablad pues: Su voz clara y dulce formará vuestro oido. Hablad pues sin temor, porque en vuestra edad hasta los tropiezos de un extranjero son un adorno.

Seid moderados en vuestros placeres, sin olvidar la máxima de Don Quijote que "el vino demasiado no guarda secreto ni cumple palabra." Como soldados del pueblo, sea vuestra divisa la que hay escrita en las famosas espadas de Toledo "no me saques sin razon, no me embaines sin honor."

Que Dios dirija vuestros pasos y estad seguros que si cualquiera de vosotros se distingue algun dia por alguna accion de noble humanidad, ó de brillante bravura militar, el jefe del departamento y vuestros instructores de Español al relatarla á los que quedan en la escuela para que les sirva de ejemplo, exclamarán con orgullo: "Este tambien ha sido uno de nuestros discípulos."

Dios os guarde, señores: EL JEFE Y LOS INSTRUCTORES DEL RAMO DE ESPAÑOL.

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

CHEMISTRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, two hours.*

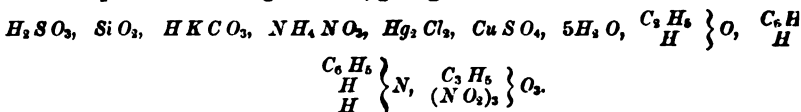
1. Explain the distinction between chemical compounds and mechanical mixt Under which head does *air* come, and what are the proofs?

2. What are the products of the combustion of coal? What are the condition the production of the maximum of heat from a given quantity of fuel?

3. Explain the chemistry of steam-boiler incrustation resulting from the acti (1) fresh water and (2) sea-water.

4. Give the *rationale* of soap-manufacture, with the chemical constitution of saponifiable fats.

5. Interpret the following formulas, giving chemical and common names:



6. Discuss the principle and applications of the so-called galvanic action of t more metals in contact, and in the presence of corroding agents.

7. What compounds constitute the ordinary ores of iron, zinc, tin, lead, copper ver, mercury, and gold? Give formulas.

8. What is the chemical constitution of cast iron? How is it converted into wro iron and steel? Give the chemical phenomena of the processes.

CHEMICAL ANALYSIS (QUALITATIVE).

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

One of the following complex substances was given to each Cadet:

1. White paint in oil (zinc white);
2. White paint in oil (impure lead white);
3. Green paint in oil (Prussian blue and chrome yellow);
4. Fresh-water boiler-scale;
5. Rumford yeast-powder (acid phosphate of calcium and bicarbonate of soda);
6. Ultramarine blue, dry;
7. Type-metal;
8. German silver.

(The oil-paints were washed free of oil and dried, after the Cadets had shown that they knew this was effected.)

ELECTRICITY AND MAGNETISM.

MONTHLY EXAMINATION.

APRIL, 1874.—*Time allowed, two hours.*

1. Explain the construction and use of resistance-coils.

What would be the resistance of three wires in multiple-arc, whose res;ec resistances are 8, 25, 45 ohms?

2. Suppose two uniform conductors of unequal resistances, to be represented by lines *CD* and *FG*; the first conductor is 8 kilometers, and the second, 24 kilome long; the difference of potential between *C* and *D*, and between *F* and *G* is 25 v. If one end of a galvanometer-wire be attached to the first conductor, 3 kilometers f

C, at what point of *FG* must the other end of the galvanometer-wire be attached in order that there shall be no deflection of the needle?

3. Describe the construction, mode of action, important applications, and defects of magneto-electrical machines.

4. Give a method for determining the position of a fault in a telegraph-line, when the fault is large, and its resistance nearly constant.

5. How can the position of a fault be found by means of a return-wire, so that the result shall not be affected by any variation in the resistance of the fault?

ELECTRICITY AND MAGNETISM.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. What is the meaning of the word *potential* as used in electricity? How may the difference of potential be measured?

2. Make it evident that you know the direction of currents induced in a neighboring conductor by the change of position of a magnet, or of a wire through which a current is passing, or by the increase or decrease of the strength of the magnet, or of the current in the wire. What common properties have solenoids and magnets?

3. What is an *ion*? What determines the quantity of an electrolyte decomposed? If an absolute electro-magnetic unit of current decomposes in one second 0.00092 grammes of water, how much silver will be deposited per hour by a current produced by a battery of a constant electro-motive force of 56 volts, overcoming a resistance of 8 ohms?

4. In a thermo-electric pile, to what is the work done by the current equivalent? What is an expression, containing the mechanical equivalent of heat, for the electro-motive force absolutely necessary to effect the decomposition of an electrolyte?

5. Explain the construction and action of Carré's dielectrical machine. Explain the construction and action of Thompson's reflecting electrometer.

6. If the difference of potential between *A* and *B* is maintained at 28 volts, and three points be connected in multiple-arc by two wires of 5 and 12 ohms resistance, respectively, what will be the strength of the current measured in farads? Describe the construction and action of Grove's cell.

7. Compare the cost and advantages of the potential energy, mechanical energy, and useful mechanical effect resulting from the consumption of zinc in a galvanic battery with those developed by the use of coal in the ordinary engine. Describe the construction and special advantages of the Siemen's armature.

8. What is the most important electro-motor in use? Explain how telegraphic messages can be sent simultaneously in both directions through one wire. Describe some method of determining the position of a fault in a telegraph-line.

9. Explain the construction and use of the Wheatstone bridge. What determines the choice of a galvanometer for a special purpose?

In the department of Physics and Chemistry, the papers set for the Cadet-Engineers of the First Class, in the subject of *Mechanics and Applied Mathematics*, are the same as those set for the Cadet-Midshipmen of the Second Class, and in the subject of *Heat*, the same as those set for the Cadet-Midshipmen of the First Class.

DEPARTMENT OF STEAM ENGINEERY.

STEAM-ENGINEERY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

I.

Describe the various strains to which material may be subjected, giving an instance of each from the steam-engine. Explain the meaning of the terms: ultimate strength, proof-strength, working-load, set, resilience, factor of safety.

II.

Calculate the greatest pressure in pounds per square inch that may be employed in a cylindrical boiler of 8 feet diameter, containing a cylindrical furnace-flue of $4\frac{1}{2}$ feet diameter, and $\frac{1}{4}$ inch thickness, built in three sections of 2 feet each, and strengthened at the ends of the sections beyond the ultimate strength of the plate. Factor of safety:

III.

Give the thickness of the shell of the boiler described in question II; the shell be double-riveted, and the tensile strength of boiler-plate being taken at 54000 pounds per square inch of cross-section.

IV.

What would be the least diameter of wrought-iron brace-rods for opposite segment portions of the heads of a cylindrical boiler of 8 feet diameter and 8 feet in length the versed-sine of the segments being $2\frac{1}{2}$ feet, the braces 16 in number, and the pressure per gauge 80 pounds?

V.

Define *moment of flexure* and *leverage*, and give the formulas for resistance to breaking under the five general conditions. Give the breadth and thickness of a wrought-iron crank of an engine of 10 feet stroke of piston, by which 500 horse-power is developed, with a piston-speed of 500 feet per minute. Initial pressure (absolute) 40 pounds per square inch.

VI.

The cast-iron dome surmounting the steam-drum of a boiler carrying 80 pounds steam is spherical, with a radius of 1 foot. The dome being flanged, and secured by bolts, what is the nature of the strains at its base, and what thickness will suffice to resist them, taking 8 as the factor of safety, and 15,000 pounds as the tenacity?

VII.

What is meant by absolute zero? How is it determined?

VIII.

If 3 pounds of coal of the components, $C = 0.915$, $H = 0.035$, $O = 0.026$ are required to develop a horse-power per hour, what per centum of the fuel is utilized, and to what causes may be attributed, the loss of the remainder?

IX.

Calculate the number of pounds of air required for the perfect combustion of 1 ton (2240 pounds) of coal, and the number of pounds of water it should evaporate under atmospheric pressure from a temperature of 110° Fah.

X.

Draw diagrams from the same cylinder, using the same pressure, viz, 80 pounds per gauge, as follows:

(a) A pair of diagrams, showing cut-off $\frac{1}{4}$ from beginning of stroke, supposing the engine to be condensing.

(b) A pair of diagrams, showing cut-off at $\frac{1}{4}$ from the beginning, supposing the engine to be non-condensing.

(c) A pair of diagrams (condensing), designed to cut-off at $\frac{1}{4}$ -stroke, but showing the eccentric to have slipped backward apparently 45° .

(d) A pair of diagrams (non-condensing), designed to cut-off at $\frac{1}{4}$ -stroke, with valve stem considerably too long.

SECOND CLASS.

DEPARTMENT OF MATHEMATICS.

DESCRIPTIVE GEOMETRY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

Pass a plane through $A \dots (4.0, 1.5, 1.0)$, making an angle of 45° with V and 60° with H .

Pass a plane through $B \dots (4.5, 1.75, 0.5)$, making an angle of 75° with V and 45° with H .

Find the shortest distance between the line AB , and the intersection of these two planes.

Draw a line through the point $A \dots (4.5, 1.0, 2.0)$, making an angle of 45° with V and 90° with H .

Propose this line to revolve about the fixed line which passes through A and $(3.5, 1.5, 0.0)$, always remaining at the same angle with it. Find the horizontal and vertical projections of the surface so generated.

Pass a plane tangent to this surface through the point $\dots (5.5, 1.0, 1.0)$.

A ring is generated by the revolution of a circle about an axis in its plane; find the true form of a section of this ring made by a plane tangent to its inner surface;

the centre of the generating circle at $\dots (6.0, 3.0, 1.0)$, and its radius $\frac{3}{4}$; the axis vertical and passing through $\dots (4.0, 3.0, 0.0)$, the cutting-plane perpendicular to V , and making an angle of 45° with H .

A spheroid is generated by the revolution of an ellipse, whose semi-axes are 1.25 and 0.75, about its major axis. Taking the centre of the ellipse at $\dots (3.0, 2.0, 2.0)$, and its major axis vertical, find the true form of a section of the spheroid made by a plane passing through the upper vertex of the ellipse, perpendicular to V , and making an angle of 60° with H .

Pass a plane tangent to the spheroid at a point of its upper surface, the horizontal projection of which is at $\dots (3.5, 1.5, 0.0)$.

Two cones, each having a circular base, stand on H . The radius of the base of the first is $2''$, and centre at $\dots (3.0, 2.5, 0.0)$; and its vertex is at $\dots (3.5, 2.0, 1.5)$; the radius of the base of the second is $1''$; its centre is at $\dots (3.25, 2.5, 0.0)$; and its vertex at $\dots (4.5, 0.5, 2.5)$; it is required to find the horizontal and vertical projections of their common section.

An hyperboloid is generated by the revolution of the indefinite line passing through $A \dots (2.0, 1.75, 2.25)$, $B \dots (4.75, 1.0, 0.0)$, about a vertical axis passing through $C \dots (1.5, 2.25, 0.0)$; find the horizontal and vertical projections of the surface so generated, and find the true form of a section of this surface made by a plane perpendicular to V , and parallel to an element of the asymptotic cone; let this plane pass through the right-hand extremity of that diameter of the circle of the gorge which is parallel to the ground-line.

Construct the tetrahedron $V-ABC$, having given—

$C \dots (4.5, 1.5, 1.0)$,	$CV, \dots \dots \dots 1''$.
$B \dots (3.0, 2.0, 1.5)$,	$BF, \dots \dots \dots 2''$.
$A \dots (2.0, 1.0, 1.0)$,	$AV, \dots \dots \dots 2''$.

Inscribe a sphere about this tetrahedron.

Pass a plane tangent to the three spheres whose centres are at the points $A \dots (2.0, 0.5, 1.0)$, $B \dots (4.5, 1.5, 1.0)$, and $C \dots (3.5, 2.25, 0.75)$; and whose radii are respectively $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{3}{8}$.

The papers set for the Cadet-Engineers of the Second Class in *Algebra*, *Plane Trigonometry*, and *Analytical Geometry* were the same as those set for the Fourth Class of Cadet-Midshipmen in January and May, and for the Third Class of Cadet-Midshipmen in January and May.

* Alternatives.

Too great and too little lead ; too great compression ; scantiness of opening of ports.

8. Describe the apparatus known as Sewell's surface-condenser, mentioning any peculiarities that pertain to the pumps used in connection with it.

9. Given, the diameter of the cylinder of a non-condensing engine, 2 feet ; the stroke of piston, 6 feet ; pressure per gauge, 40 pounds ; cut-off at $\frac{1}{2}$ from beginning of stroke ; revolutions, 70 per minute ; back pressure, 2 pounds above the atmosphere.

Draw the indicator-diagram, and calculate the horse-power, neglecting clearance.

10. State the advantages derived from the practice of surface-condensation in general.

ERRATA.

On page 7, in place of CAPTAIN KIDDER RANDOLPH BREESE, read COMMANDER EDWARD TERRY ; in place of *Commandant of Midshipmen*, read *Commandant of Cadets*.

On page 8, after PASSED ASSISTANT ENGINEER THOMAS WHITESIDE RAE, insert C. E.

INDEX.

Academic Board, 10.

Admission of cadet-midshipmen, Examination for, 32.

Admission of cadet-midshipmen, Regulations governing, 47.

Admission of cadet-midshipmen, Requisites for, 50.

Admission of cadet-engineers, Examination for, 57.

Admission of cadet-engineers, Regulations governing, 55.

Algebra, Course in, 61.

Algebra, Examination for admission, cadet-engineers, 57.

Algebra, examination-papers, 67, 68, 69.

Arithmetic, Examination for admission, 52, 53, 57.

Artillery drills, 60.

Astronomy, Course in, 61.

Astronomy, examination-papers, 91.

Bugle, Instruction in, 60.

Cadet-officers, 11.

Calculus, Course in, 62.

Calculus, examination-papers, 92, 93, 94.

Calendar, Academic, 5.

Calendar, Civil, 6.

Chemistry, Course in, 62.

Chemistry, examination-papers, 83, 110.

Competitive examination for admission of cadet-engineers, 57.

Constellation, Officers and cadet-midshipmen, U. S. S., 29.

Course of instruction, cadet-midshipmen, 60.

Course of instruction, cadet-engineers, 65.

Cruise, Practice, 29.

Dancing, Instruction in, 60.

Deficient, Cadets found, 49.

Deposit on admission, 49.

Dismissals, 29.

Drawing, Course in, 64.

Drills, 60.

Electricity, examination-papers, 91, 110, 111.

English, Course in, 63.

English, examination-papers, 73, 74.

Examination for admission, 50, 57.

Examination-papers, 1873-'74, 67.

Expenses, 48.

Fabrication of guns, 99.

Fencing, Instruction in, 60.

First class, cadet-midshipmen, relative standing, 16.

First class, cadet-midshipmen, 1873-'74, merit-roll, 34.

First class, cadet-engineers, relative standing, 25.

First class, cadet-engineers, 1873-'74, merit-roll, 42.

Fourth class, cadet-midshipmen, 23.

Fourth class, cadet-midshipmen, 1873-'74, merit-roll, 39.

Fourth class, cadet-engineers, 36.

French, Course in, 63.

French, examination-papers, 76, 86, 95.

Geography, Examination for admission in, 53, 54, 58.

Geometry, Course in, 61.

Geometry, Examination for admission in, cadet-engineers, 57.

Geometry, examination-paper, 71.

Geometry, Analytical, examination-papers, 82.

Geometry, Descriptive, examination-paper, 113.

Graduating class, relative standing, cadet-midshipmen, 14.

Graduating class, relative standing, cadet-engineers, 25.

Grammar, Examination for admission in, 52, 54, 58.

Gunnery, Course in, 60.

Gunnery, examination-papers, 90, 99.

Gymnastics, Instruction in, 60.

Heat, examination-paper, 102.

Historical sketch, 3.

History, Course in, 63.

History, examination-papers, 71, 84.

Japan, Students from, 26.

Law, Course in, 63.

Law, examination-paper, 106.

Light, examination-papers, 103, 104.

Marine garrison, Officers of, 9.

Mates, 9.

Mayflower, Officers and cadet-engineers, U. S. S., 30.

Mechanical drawing, examination-paper, 114.

Mechanics, Course in, 62.

Mechanics, examination-papers, 92, 94, 95.

Merit-rolls, Explanation of, 31, 33.

Mortar-practice, 60.

Natural philosophy, Examination for admission in, 59.

Navigation, Course in, 61.

Navigation, examination-papers, 99, 100, 101.

Officers of the Naval Academy, 7.

Officers not attached to the academic staff, 9.

Ordinance instructions, examination-paper, 79.

Physical geography, Course in, 63.

Physics, Course in, 62.

Programme of studies, cadet-midshipmen, 64, 65.

Programme of studies, cadet-engineers, 65, 66.

Projections, Stereographic, examination-paper, 79.

Qualitative analysis, examination-paper, 110.

Relative weight of studies, Table of the, 32.

Resignations, 27.

Rhetoric, Course in, 63.

Rhetoric, examination-paper, 85.

Seamanship, Course in, 60.

Seamanship, examination-papers, 77, 89, 97.

Second class, cadet-midshipmen, relative standing, 18.

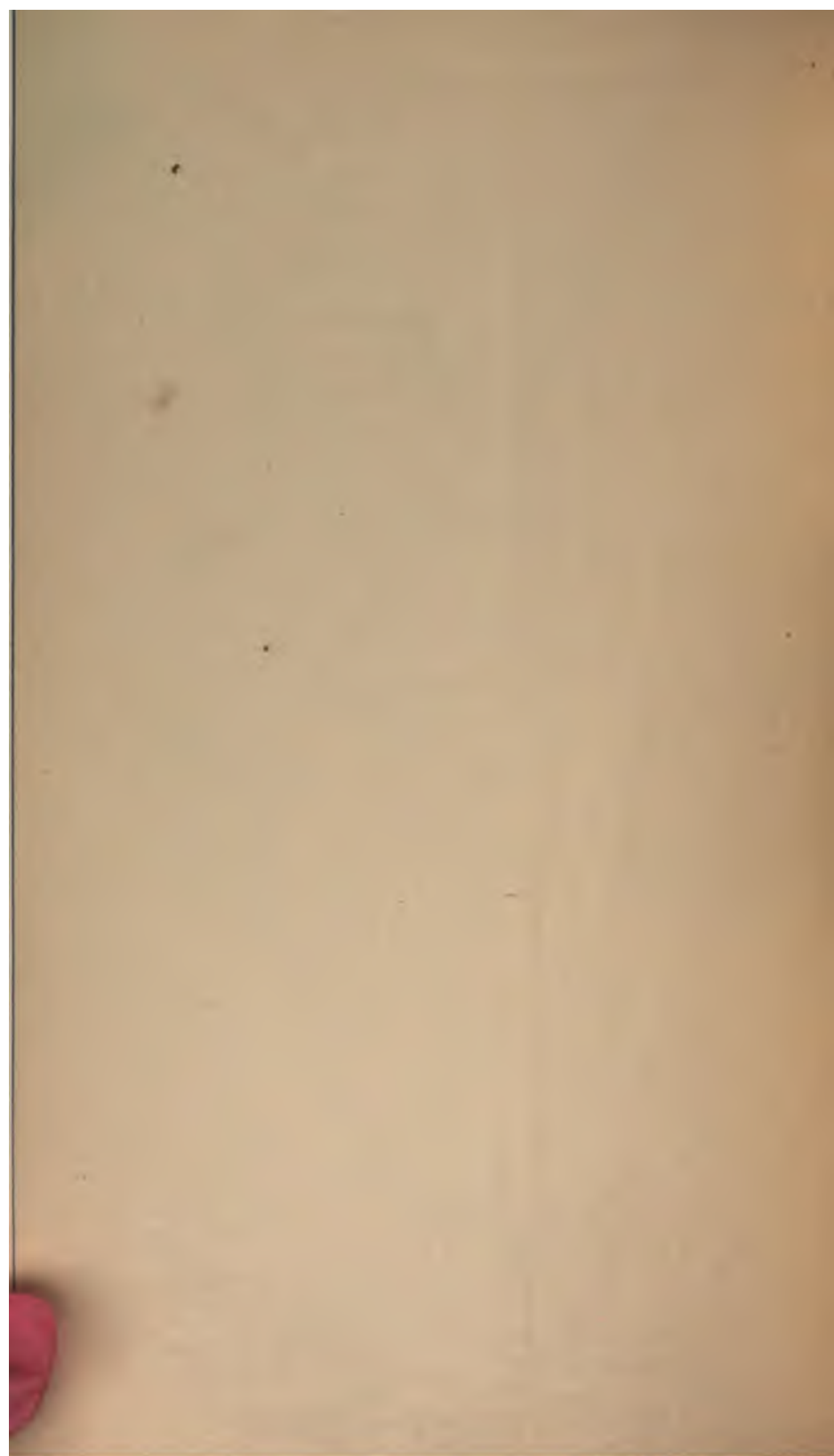
INDEX.

- 873-74, merit- Surveying, Course in, 62
- 873-74, merit- Swimming, Instruction in, 60
- 873-74, merit- Tactics, Course in, naval and infantry, 6
- 873-74, merit- Tactics, examination-papers, infantry, 6
- 873-74, merit- Tactics, examination-papers, naval, 6
- 873-74, merit- Text-books, 60, 61, 62, 63, 64
- 873-74, merit- Third class, cadet-midshipman, relative
- 873-74, merit- ing, 20
- 873-74, merit- Third class, cadet-midshipman, 80-70, 6
- 873-74, merit- roll, 37
- 873-74, merit- Traveling expenses, 48, 49
- 873-74, merit- Trigonometry, Course in, 61
- 873-74, merit- Trigonometry, examination-papers, 61, 62
- 873-74, merit- Visitors, Board of, 4

Store
4th

UNITED

TWENTY



CONTENTS.

	Page.
HISTORICAL SKETCH.....	5
BOARD OF VISITORS.....	6
CALENDAR, 1875-76.....	6
OFFICERS.....	8
ACADEMIC BOARD.....	11
CADET-OFFICERS.....	11
CADETS, WITH RELATIVE STANDING IN CLASSES.....	12
NUMERICAL SUMMARY.....	26
RESIGNATIONS, DISMISSALS, AND DEATHS.....	27
PRACTICE-CRUISE, 1875.....	28
TABLE OF COEFFICIENTS.....	30
MERIT-ROLLS, 1874-75.....	31
REQUISITES FOR ADMISSION.....	39
COURSE OF INSTRUCTION.....	51
PROGRAMME OF STUDIES.....	54
EXAMINATION-PAPERS, 1874-75.....	58
INDEX.....	97



THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The School at its establishment numbered 56 Midshipmen, of whom 36, of the date of 1846, were preparing for examination; 13, of the date of 1841, were to remain at their studies until ordered to sea; and 7, just appointed, were to take the regular course, which was fixed as one year at the School, three years at sea, and a fifth and final year at the School, before promotion. Later, the course was altered to seven years, of which the first two and last two were at the School, and the intervening years at sea.

In October, 1849, a board of officers was appointed to re-organize the School. A new system was devised, and carried into operation, July 1, 1850. By this, the course of instruction was made more extensive, and arranged to cover four consecutive years; the corps of Professors was increased, and a Sloop-of-war, the *Preble*, was attached to the School as a practice-ship. The new school was called the Naval Academy, and was placed under the supervision of the Chief of the Bureau of Ordnance and Hydrography. A board of visitors was appointed to examine into the state of the Academy annually, and to make a report upon its condition to the Secretary of the Navy. The first class of Acting Midshipmen under the four years' course entered in October, 1851, and was graduated in June, 1854.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the *Frigate Constitution*. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. This system was followed till March 11, 1869, when all connection with the Bureau ceased.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class was graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and was graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874, and the second last summer. By an act of Congress, approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years, instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

There are now three classes of Cadet-Engineers at the Academy: the first, composed of Cadets turned back from the class last graduated, on account of deficiency scholarship, whose course ends in 1876; the third, which entered in 1874, under new law; and the fourth, admitted in September, 1875.

BOARD OF VISITORS, JUNE, 1875.

Commodore FOXHALL A. PARKER, U. S. N., *President*.
 Brevet Major-General E. O. C. ORD, U. S. A., *Vice-President*.
 Captain GEORGE E. BELKNAP, U. S. N.
 Pay-Director ROBERT PETTIT, U. S. N.
 Chief-Engineer ALEXANDER HENDERSON, U. S. N.
 Major W. E. POTTER, of New Jersey.
 Rev. O. H. TIFFANY, D. D., of Illinois.
 Professor J. G. JAMES, of Texas.
 Professor E. S. CARR, of California.
 Professor A. M. GOW, of Indiana.

CALENDAR.

1875-76.

1875.		
Sept.	20.—Beginning of first term	Monday.
1876.		
Jan.	24-29.—Semi-annual examination	Monday-Saturday
Jan.	29.—End of first term	Saturday.
Jan.	31.—Beginning of second term	Monday.
June 10-20.	—Annual examination	Saturday-Tuesday
June	20.—End of academic year 1875-76	Tuesday.
June	21.—Examination of candidates for admission as Cadet-Midshipmen	Wednesday.
Sept.	5.—Examination of candidates for admission as Cadet-Engineers	Tuesday.
Sept.	12.—Examination of candidates for admission as Cadet-Midshipmen	Tuesday.
Sept.	20.—Beginning of first term 1876-77	Wednesday.

The academic months of 1875-76 end on the following days:

October	Oct. 23	February	Mar.
November	Nov. 20	March	April
December	Dec. 18	April	April
January	Jan. 22	May	June

CALENDAR FOR 1875-76.

SEPTEMBER.							MARCH.						
Sun.	M.	T.	W.	T.	F.	Sat.	Sun.	M.	T.	W.	T.	F.	Sat.
....	....	....	1	2	3	4	...	...	....	1	2	3	4
5	6	7	8	9	10	11	5	6	7	8	9	10	11
12	13	14	15	16	17	18	12	13	14	15	16	17	18
19	20	21	22	23	24	25	19	20	21	22	23	24	25
26	27	28	29	30	....	....	26	27	28	29	30	31	....
OCTOBER.							APRIL.						
....	....	....	....	....	1	2	....	....	....	....	....	....	1
3	4	5	6	7	8	9	2	3	4	5	6	7	8
10	11	12	13	14	15	16	9	10	11	12	13	14	15
17	18	19	20	21	22	23	16	17	18	19	20	21	22
24	25	26	27	28	29	30	23	24	25	26	27	28	29
31	....	....	....	....	....	....	30	....	....	....	....	....	....
NOVEMBER.							MAY.						
....	1	2	3	4	5	6	....	1	2	3	4	5	6
7	8	9	10	11	12	13	7	8	9	10	11	12	13
14	15	16	17	18	19	20	14	15	16	17	18	19	20
21	22	23	24	25	26	27	21	22	23	24	25	26	27
28	29	30	....	....	....	....	28	29	30	31	....	....	....
DECEMBER.							JUNE.						
....	....	....	1	2	3	4	....	....	....	....	1	2	3
5	6	7	8	9	10	11	4	5	6	7	8	9	10
12	13	14	15	16	17	18	11	12	13	14	15	16	17
19	20	21	22	23	24	25	18	19	20	21	22	23	24
26	27	28	29	30	31	....	25	26	27	28	29	30	....
JANUARY.							JULY.						
....	....	....	....	....	....	1	....	....	....	....	....	....	1
2	3	4	5	6	7	8	2	3	4	5	6	7	8
9	10	11	12	13	14	15	9	10	11	12	13	14	15
16	17	18	19	20	21	22	16	17	18	19	20	21	22
23	24	25	26	27	28	29	23	24	25	26	27	28	29
30	31	....	....	....	....	....	30	31	....	....	....	....	....
FEBRUARY.							AUGUST.						
....	....	1	2	3	4	5	....	....	1	2	3	4	5
6	7	8	9	10	11	12	6	7	8	9	10	11	12
13	14	15	16	17	18	19	13	14	15	16	17	18	19
20	21	22	23	24	25	26	20	21	22	23	24	25	26
27	28	29	....	....	....	....	27	28	29	30	31	....	....

OFFICERS
OF THE
UNITED STATES NAVAL ACADEMY.

REAR-ADMIRAL
CHRISTOPHER RAYMOND PERRY RODGERS,
SUPERINTENDENT.
COMMANDER-NORMAN VON HELDREICH FARQUHAR,
Senior Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER EDWARD TERRY,
Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER HENRY LYCURGUS HOWISON,
Head of Department.

LIEUTENANT-COMMANDER SILAS WRIGHT TERRY,
LIEUTENANT-COMMANDER COLBY MITCHELL CHESTER,
LIEUTENANT-COMMANDER CHARLES VERNON GRIDLEY,
LIEUTENANT EUGENE DE FOREST HEALD,
Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,
Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER JAMES O'KANE,
Head of Department.

LIEUTENANT-COMMANDER MERRELL MILLER,
In charge of practice-ships.

LIEUTENANT-COMMANDER ALBERT GALLATIN CALDWELL,
LIEUTENANT-COMMANDER ROWMAN HENDRY MCCALLA,
LIEUTENANT SIDNEY AUGUSTUS SIMONS,
LIEUTENANT ALBION VARETTE WADHAMS,
Instructors in Naval Gunnery and Infantry Tactics.

ANTOINE J. CORBESIER,
Sword-Master.

JEAN B. REIZ,
GEORGE HEINTZ,
Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR WILLIAM WOODBURY HENDRICKSON,
Head of Department.

LIEUTENANT-COMMANDER CHARLES WILLIAM KENNEDY,
LIEUTENANT-COMMANDER SAMUEL HOUSTON BAKER,
LIEUTENANT SOCRATES HUBBARD,
LIEUTENANT JAMES HENRY DAYTON,
LIEUTENANT ASA WALKER,
LIEUTENANT CHARLES STILLMAN SPERRY,
ENSIGN WILLIAM HENRY HUDSON SOUTHERLAND,
ENSIGN JESSE MIMS ROPEL,
ENSIGN THOMAS BENTON HOWARD.

Instructors in Mathematics.

STEAM-ENGINEERY.

CHIEF ENGINEER CHARLES HENRY BAKER,
Head of Department.

PASSED ASSISTANT ENGINEER THOMAS WHITESIDE RAE, C. E.,
PASSED ASSISTANT ENGINEER JOHN LIVINGSTON DINWIDDIE BORTHWICK, A. M.,
PASSED ASSISTANT ENGINEER WILLIAM LEONARD NICOLL,
PASSED ASSISTANT ENGINEER GEORGE EDWARD TOWER,
PASSED ASSISTANT ENGINEER DAVID JONES,
ASSISTANT ENGINEER CHARLES WHITESIDE RAE, C. E.,

Instructors in Steam-Engineery.

ASTRONOMY, NAVIGATION, AND SURVEYING.

COMMANDER JOHN ADAMS HOWELL,
Head of Department.

LIEUTENANT-COMMANDER PURNELL FREDERICK HARRINGTON,
LIEUTENANT RAYMOND PERRY RODGERS,
LIEUTENANT CHARLES PLUMMER PERKINS.

Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

COMMANDER WILLIAM THOMAS SAMPSON,
Head of Department.

LIEUTENANT-COMMANDER ALBERT SMITH BARKER,
LIEUTENANT-COMMANDER THEODORE FRIELINGHUYSEN JEWELL,
PROFESSOR NATHANIEL MATSON TERRY, A. M., PH. D.,
PROFESSOR CHARLES EDWARD MUNROE, S. B.,

Instructors in Physics and Chemistry.

PROFESSOR JOHN MINOT RICE, S. B.,
LIEUTENANT HARRY KNOX,
LIEUTENANT CHARLES CARPENTER CORNWELL,

Instructors in Applied Mathematics and Mechanics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR JAMES RUSSELL SOLEY, A. B.
Head of Department.

LIEUTENANT CHARLES BELKNAP,
LIEUTENANT EDWARD PARKER WOOD,
LIEUTENANT WILLIAM PARKER POTTER,
LIEUTENANT JOHN BRADFORD BEIGGS,
ASSISTANT PROFESSOR WILLIAM WIRT FAY, A. M.,
ASSISTANT PROFESSOR FREDERICK SNOW, A. B.,
ASSISTANT PROFESSOR ELIOT LOED, A. B.,

Instructors in English Studies, History, and Law.

10 OFFICERS OF THE UNITED STATES NAVAL ACADEMY.

MODERN LANGUAGES.

COMMANDER WINFIELD SCOTT SCHLEY,
Head of Department.

LIEUTENANT-COMMANDER JOHN SCHOUER,
ASSISTANT PROFESSOR PEDRO MONTALDO,
Instructors in Spanish.

PROFESSOR LUCIEN FRANKLIN PRUD'HOMME,
ASSISTANT PROFESSOR ALPHONSE V. S. COURCELLE,
ASSISTANT PROFESSOR EUGENE DOVILLIERS,
ASSISTANT PROFESSOR JULES LEROUX,
ASSISTANT PROFESSOR HIPPOLYTE DALMOS,
Instructors in French.

DRAWING.

PROFESSOR RICHARD SOMERS SMITH, A. M.,
Head of Department.

ASSISTANT PROFESSOR MARSHAL OLIVER,
ASSISTANT PROFESSOR CHARLES FRANCIS BLAUVELT, N. A.,
Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

MEDICAL INSPECTOR ALBERT LEARY GIHON, A. M., M. D.
SURGEON GEORGE ADAMS BRIGHT, M. D.
ACTING PASSED ASSISTANT SURGEON JOSEPH JOHN SOWERBY, M. D.
ACTING ASSISTANT SURGEON THOMAS OLIVER WALTON, M. D.
PAYMASTER ALBERT SEWALL KENNY, A. B.
PAYMASTER SAMUEL TRACEY BROWNE, *Storekeeper.*
CHAPLAIN JOHN RUTHERFORD MATTHEWS, A. M.
ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
JAMES JOHNSON GRAFF, *Assistant Librarian.*
RICHARD SWANN, *Commissary.*
RICHARD MOALE CHASE, *Secretary.*

JAMES G. GLYNN, *First Clerk.*
SAMUEL JICKLING, *Second Clerk.*
CHARLES MARION MCLEOD, *Clerk to Commandant of Cadets.*
EUGENE WORTHINGTON, *Third Clerk to Superintendent.*

MARINE GARRISON.

CAPTAIN McLANE TILTON, *Commanding.*
FIRST LIEUTENANT HENRY CLAY COCHRANE.
FIRST LIEUTENANT JAMES M. T. YOUNG.
FIRST LIEUTENANT DANIEL PRATT MANNIX.
FIRST LIEUTENANT SAMUEL KUYPER'S ALLEY.

MATES.

C. J. MURPHY	} Attached to the United States Gunnery-ship <i>Staten</i> and to the Sloop-of-war <i>Dale</i> .
WILLIAM G. SMITH	
L. M. MELCHER	
T. W. BONNALL	
ROBERT SILVER	} Attached to United States Steamer <i>Leshigh</i> (iron-clad).
BENJAMIN G. PERRY	
JOSEPH RODGERS	

(steam-tender).

ACADEMIC BOARD.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N.
 COMMANDER EDWARD TERRY, U. S. N.
 COMMANDER J. A. HOWELL, U. S. N.
 COMMANDER H. L. HOWISON, U. S. N.
 COMMANDER JAMES O'KANE, U. S. N.
 COMMANDER W. S. SCHLEY, U. S. N.
 COMMANDER W. T. SAMPSON, U. S. N.
 CHIEF ENGINEER C. H. BAKER, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 PROFESSOR R. S. SMITH, A. M.
 PROFESSOR J. R. SOLEY, A. B.

CADET-OFFICERS.

CADET LIEUTENANT-COMMANDER.

GEORGE C. FOULK.

CADET-LIEUTENANTS.

W. L. VARNUM.
STEPHEN JENKINS.

LOVELL K. REYNOLDS.
HENRY C. GEARING.

CADET-MASTERS.

S. J. BROWN.
W. H. ALLEN.

C. J. BOUSH.
T. G. WINCH.

ADJUTANT.

T. M. POTTS.

CADET-ENSIGNS.

W. J. CHAMBERS.
J. H. SEARS.

C. C. ROGERS.
R. T. MULLIGAN.

CADET PETTY-OFFICERS.

First Captains of Gun's Crews.

R. C. Ray.
 A. E. Jardine.
 E. M. Kata.
 J. T. Newton.
 Dewitt Coffman.
 Richard Henderson.

Benjamin Tappan.
 E. E. Wise.
 W. D. Rose.
 C. A. Gove.
 H. T. Mayo.

W. S. Hogg.
 L. W. Piepmeyer.
 William Braunersreuther.
 B. T. Walling.
 A. E. Culver.

Second Captains of Gun's Crews.

W. F. Fullam.
 C. F. Pond.
 A. G. Winterhalter.
 A. W. Collins.
 D. R. Case.
 S. B. Mallory.

W. V. Bromaugh.
 O. G. Dodge.
 Alfred Jeffries.
 Walter McLean.
 W. G. David.

J. C. Gilmore.
 F. H. Sherman.
 J. M. Orchard.
 H. M. Witsel.
 J. McL. Proudft.

MIDSHIPMEN.

Graduating class of 1875—32 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—										Number of demerits.	Sea-service in practice-ships.		
				Years.	Months.	Seamanship.	Practical exercises.	Naval architecture.	Gunnery.	Fencing.	Steam-engineery.	Navigation.	Heut.	Light.	Law.		Spanish.		
*1	Hodgson, Albon Chase	Georgia	June 5, 1871	17	10	6	6	1	2	15	1	1	1	1	1	1	55	6	26
*2	Amnden, Charles Heath	Ohio	Sept. 20, 1871	17	11	9	1	7	6	1	4	11	15	12	20	4	62	6	26
*3	Winslow, Cameron McRae	At large	Sept. 27, 1870	16	1	5	5	5	3	3	14	5	11	8	9	13	26	6	26
*4	Helm, James Meredith	Tennessee	Sept. 20, 1871	15	9	1	7	5	11	2	2	2	3	6	5	10	95	6	26
*5	Cutler, William Gifford	At large	Sept. 20, 1871	16	11	8	11	8	11	22	20	6	9	19	11	2	60	6	26
*6	Corbin, Clarence Arthur	Michigan	Sept. 26, 1870	17	2	4	8	3	7	8	12	14	19	9	13	11	117	10	4
*7	Cartier, Fydelio Sharps	Illinois	Sept. 29, 1870	17	4	2	2	27	4	6	14	20	31	15	3	21	31	10	4
*8	Coffin, Frederick Wesley	Massachusetts	June 15, 1870	17	9	3	15	11	10	17	18	16	12	9	2	6	125	6	26
*9	Hosley, Harry Hubbard	New Hampshire	Sept. 22, 1871	15	10	11	20	6	19	29	5	3	2	21	25	3	120	6	26
*10	Laird, Charles	Ohio	Sept. 22, 1870	16	7	14	10	18	8	24	9	16	17	7	14	24	86	6	26
*11	Hughes, Walter Scott	Iowa	Sept. 24, 1870	17	11	29	26	15	19	26	7	11	13	5	20	16	25	6	26
*12	Usher, Nathaniel Reiley	Indiana	Sept. 21, 1871	16	5	14	15	25	16	12	8	15	25	22	20	16	107	6	26
*13	Hodges, Harry Marsh	Illinois	Sept. 29, 1870	15	3	26	19	13	19	30	16	9	22	13	24	26	22	6	26
*14	Fletcher, Frank Friday	Iowa	Sept. 22, 1870	14	10	24	20	17	22	11	29	11	19	4	19	19	73	10	4
*15	Daniels, David	Massachusetts	June 5, 1871	15	4	7	12	3	24	19	11	9	7	24	7	5	20	6	26
*16	Sharp, Alexander, Jr.	District of Columbia	June 20, 1870	14	7	28	4	10	13	10	3	8	6	11	12	27	32	10	4
*17	Wood, Moses Lindley	Missouri	Sept. 21, 1871	17	1	24	26	21	1	9	5	22	4	14	18	9	72	6	26
*18	Townley, Richard Henry	Nebraska	June 20, 1870	17	4	23	25	12	9	13	13	25	24	18	23	14	61	6	26
*19	Bostick, Edward Dorsey	South Carolina	Sept. 24, 1870	17	1	21	12	13	13	18	25	24	15	16	4	25	80	10	4
*20	Winchester, George Henry	New York	Sept. 26, 1871	14	3	31	26	19	5	26	9	4	0	0	27	10	91	6	26
*21	Shorruan, John Adams	New York	June 7, 1871	16	10	18	18	31	22	7	22	18	20	27	30	23	141	6	26

MIDSHIPMEN—GRADUATING CLASS OF 1875.

13

		Testimonials																
		Sept. 21, 1871																
		17	4	13	50	09	21	10	7	2	17	13	111	6				
25	McCarthy, Charles Thomas	Sept. 21, 1870	16	4	19	31	16	28	23	22	10	10	16	8	30	26		
26	Lowe, Alfred Leighton	June 5, 1871	16	5	26	50	23	13	24	31	00	23	28	10	4			
27	Hunt, Henry Jackson	Sept. 23, 1869	15	1	32	30	20	31	32	10	17	13	8	99	6			
28	Collins, Frank Sheldon	Sept. 23, 1870	16	5	16	24	30	06	26	10	17	13	8	99	6			
29	Hunt, Ridgely	June 23, 1870	15	2	10	6	34	30	4	21	29	14	25	31	130	4		
30	Vinton, Frederick Betts	Sept. 23, 1871	17	2	30	32	9	18	13	26	27	27	6	28	64	26		
31	Caperton, William Banks	Sept. 20, 1871	16	7	18	2	32	27	16	30	30	19	25	32	26	11		
32	Stoney, George	June 5, 1871	15	11	18	12	27	23	5	26	23	30	26	11	133	6		
	Alabama	Sept. 20, 1870	17	11	12	15	29	29	21	32	42	30	32	29	32	26		

† Graduated September, 1875.

Graduated September, 1875.

14 CADET-MIDSHIPMEN, FIRST CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN.

First class—42 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—										Number of demerits.		Sea-service in practice-ships.		
				Years.	Months.	Seamanship.	Naval tactics.	Ship-building.	Gunnery.	Infantry-tactics.	Fencing.	Astronomy.	Electricity and magnetism.	Applied mathematics.	English composition.	French.	Drawing.	Months.	Days.	
6	Allen, William Herschell	Illinois	Sept. 26, 1872	15	10	24	4	8	6	1	27	3	4	10	19	15	28	41	6	11
11	Boush, Clifford Joseph	Virginia	June 5, 1872	17	9	6	15	4	27	8	25	23	19	14	30	19	11	62	6	11
42	Brannetsreuther, William	Illinois	Sept. 23, 1871	17	7	27	46	11	40	32	10	45	36	33	41	34	33	138	6	11
1	Brown, Stimpson Joseph	New York	Sept. 16, 1872	17	11	11	18	2	1	3	6	2	2	2	11	2	7	117	6	11
34	Case, Daniel Rogers	At large	June 16, 1872	15	0	30	9	20	38	21	23	28	20	38	33	27	32	193	8	28
24	Chambers, Washington Irving	New York	June 5, 1871	15	2	23	11	39	44	30	4	41	39	25	15	17	6	92	11	20
31	Coffman, De Witt	Virginia	June 6, 1872	17	6	40	32	14	19	41	6	31	21	28	43	33	26	78	6	11
14	Culver, Abraham Ellis	New York	June 5, 1872	16	2	42	11	21	15	39	36	7	17	3	8	7	17	59	8	28
29	Fisher, Elstner Nelson	Pennsylvania	Sept. 21, 1872	17	11	37	45	15	32	38	11	33	13	33	17	42	21	193	6	11
2	Foulk, George Clayton	Pennsylvania	June 14, 1872	15	7	2	2	6	2	10	16	7	8	6	4	12	8	71	8	22
3	Gearing, Henry Chalfant	Pennsylvania	June 12, 1872	17	3	6	16	9	4	1	17	1	1	1	13	8	23	121	8	28
28	Gillmore, James Clarkson	Pennsylvania	Sept. 20, 1871	17	2	32	42	31	30	25	47	29	30	24	24	30	14	84	8	25
32	Grove, Charles Augustus	New Hampshire	June 5, 1871	16	11	35	44	30	23	45	29	17	8	26	39	34	24	164	8	25
40	Griffin, Thomas Dillard	Virginia	Sept. 20, 1872	17	9	42	24	43	37	32	32	42	25	42	16	10	33	8	6	11
29	Hannum, William Gangwere	Pennsylvania	Sept. 23, 1872	16	1	14	8	25	10	28	20	25	34	40	46	21	39	174	8	28
15	Henderson, Richard	North Carolina	Sept. 28, 1872	17	1	16	20	28	7	25	21	11	31	13	37	22	4	115	6	11
35	Hogg, William Stetson	At large	Sept. 24, 1872	15	10	14	40	37	28	47	5	36	40	31	29	38	30	129	6	11
16	Jardine, Augustus Edward	At large	Sept. 21, 1870	15	8	13	17	40	21	14	21	37	27	15	19	17	22	19	12	27
7	Jenkins, Stephen	New York	Sept. 20, 1871	14	2	4	24	3	13	3	2	10	15	20	5	10	12	98	8	25
9	Katz, Edward Marc	Wisconsin	June 8, 1872	16	7	19	30	15	7	17	18	18	7	12	8	6	9	182	6	11
26	Malloy, Stevenson Blount	Virginia	June 12, 1872	16	0	39	39	33	39	28	46	12	17	17	27	22	33	132	8	28
8	Mayo, Henry Thomas	Vermont	June 13, 1872	15	6	17	3	17	11	3	44	6	5	5	33	28	24	113	6	11

16	McLean, Walter	At large	June 5, 1872	16	10	9	22	13	34	23	2	25	30	31	33	103	6	11
26	Mnett, Henry	Kentucky	June 8, 1872	15	9	22	13	34	25	36	12	27	37	19	28	107	6	11
27	Mulligan, Richard Thomas	New Jersey	June 5, 1871	15	9	19	27	47	23	35	11	32	28	34	15	137	11	20
25	Newton, John Thomas	At large	Oct. 14, 1872	17	8	21	27	26	25	12	19	32	35	21	1	44	160	6
37	Piepmeyer, Louis William	At large	Sept. 22, 1871	17	0	35	29	38	36	20	36	40	38	2	9	29	152	8
20	Pond, Charles Fremont	Connecticut	June 12, 1872	15	7	18	7	18	21	36	43	13	25	16	14	32	18	187
5	Potts, Tomplin Morris	At large	June 6, 1872	16	7	3	29	1	5	3	14	4	16	8	41	4	42	157
41	Proudt, John McLean	At large	Sept. 24, 1872	17	5	21	23	36	42	30	45	34	45	40	27	45	32	131
22	Ray, Robert Clary	At large	Oct. 1, 1872	17	11	32	32	24	34	22	40	21	37	17	44	36	39	33
17	Reynolds, Lovell Knowles	Alabama	June 5, 1871	14	4	1	14	11	14	13	9	26	22	26	24	31	19	125
10	Rogers, Charles Cutha	Tennessee	June 7, 1872	16	0	34	5	9	32	7	3	9	11	4	1	5	33	115
21	Rollins, Anthony Wayne	Kentucky	June 10, 1872	17	3	31	26	34	19	27	41	16	14	11	32	29	26	157
23	Ross, William Darcy	At large	June 5, 1872	15	11	32	21	7	0	22	27	24	40	22	12	39	16	128
12	Sears, James Hamilton	New York	Sept. 20, 1871	16	8	24	16	13	17	16	8	14	10	6	39	13	4	129
33	Sherman, Francis Howland	Missouri	Sept. 20, 1871	16	5	42	21	32	25	19	24	4	31	33	33	42	20	91
30	Tappan, Benjamin	Arkansas	Sept. 21, 1871	15	5	29	38	26	30	31	30	31	29	6	25	33	102	8
19	Varnum, William Ledy	Pennsylvania	June 5, 1871	16	6	5	1	27	18	15	15	34	24	19	7	40	45	81
4	Walling, Burns Tracy	Ohio	June 5, 1872	17	4	8	32	5	3	17	41	15	6	9	10	3	16	122
13	Winch, Thomas Garfield	Ohio	Sept. 20, 1872	17	10	10	6	23	12	11	1	19	22	29	18	22	2	94
38	Wise, Edward Everett	At large	June 5, 1871	16	6	42	32	40	41	46	34	38	42	32	3	14	2	88

16 CADET-MIDSHIPMEN, SECOND CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN
Second class—61 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Ordnance-instructions.	Mathematics.	Chemistry.	Rhetoric.	Physical Geography.	French.	Drawing.			Months.	Days.
45	Almy, Augustus Craven	At large	June 6, 1872	15	6	42	41	35	53	40	59	39	8	129		6	24
47	Benson, William Shepherd	Georgia	Sept. 21, 1872	16	11	44	35	53	52	16	8	56	58	76		6	24
16	Boatwick, Frank Matteson	Wisconsin	Sept. 26, 1873	16	5	36	2	31	4	14	29	17	11	137		3	8
32	Brice, Jonathan Kearsley	Ohio	June 13, 1873	17	8	38	18	31	24	41	31	50	55	245		3	8
6	Bronaugh, William Venable	Kentucky	June 5, 1873	17	9	10	3	3	10	12	30	24	44	122		3	9
21	Bramby, Thomas Mason	Georgia	Sept. 26, 1873	17	10	35	17	24	15	14	5	31	26	200		3	8
51	Burdick, William Leslie	Ohio	Sept. 26, 1873	16	9	20	29	59	46	44	49	59	5	220		3	8
28	Cass, Frank Blint	Michigan	June 7, 1873	15	7	9	32	37	36	53	38	54	50	223		3	8
54	Cook, Simon	Missouri	June 6, 1873	16	11	58	42	41	57	53	60	53	30	26		3	8
24	Constant, Walter Malbee	Indiana	June 13, 1873	16	3	30	4	26	36	27	16	34	54	90		3	8
7	David, William Glenn	New York	Sept. 25, 1873	17	2	10	13	10	13	4	19	14	16	160		3	8
26	Denfield, George William	Massachusetts	Sept. 26, 1873	17	1	44	45	24	40	33	40	49	48	87		3	8
36	Dodd, Arthur Wright	Indiana	June 6, 1873	16	10	51	56	13	30	43	13	10	42	93		3	8
2	Dodge, Omenzo George	Kansas	June 13, 1873	17	0	9	7	7	13	30	3	44	16	75		3	8
37	Doubaugh, Harry Mason	Ohio	June 6, 1872	16	4	23	55	29	34	50	43	58	21	118		6	24
53	Donnelly, George David	Arkansas	Sept. 21, 1872	16	6	49	59	57	28	47	53	49	12	102		6	24
41	Dunn, Herbert Omar	Rhode Island	June 6, 1873	16	0	41	34	39	23	37	33	56	10	177		3	8
43	Eodress, William Fries	New York	Sept. 25, 1873	17	1	46	21	45	55	39	35	49	1	61		3	8
31	Fechteler, Augustus Francis	At large	June 5, 1873	15	6	25	31	5	34	12	54	8	4	210		3	8
23	Fletcher, Lewis Cass	Pennsylvania	June 14, 1873	16	1	29	14	49	27	58	41	36	34	178		3	8
52	Fullam, William Freeland	New York	Sept. 24, 1873	17	11	1	1	3	3	1	1	6	13	50		3	8
5	Gleaves, Albert	Tennessee	June 10, 1873	13	5	8	12	28	21	27	12	46	51	167		3	8

18. CADET-MIDSHIPMEN, SECOND CLASS—RELATIVE STANDING

CADET-MIDSHIPMEN.

Second class—61 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Ordnance-instructions.	Mathematics.	Chemistry.	Rhetoric.	Physical Geography.	French.	Drawing.			Months.	Days.
40	Wilson, John Cochran, Jr	New York	Sept. 25, 1873	16	3	29	54	37	32	47	54	16	56	221		3	8
39	Winterhalter, Albert Gustavus	Michigan	Sept. 22, 1873	16	11	7	8	2	1	1	9	1	39	47		3	8
38	Witzel, Horace Mark	Wisconsin	June 5, 1873	15	4	3	6	1	6	7	9	29	24	101		3	8
37	Wood, Albert Norton	Indiana	Sept. 24, 1873	16	6	34	26	17	19	31	12	42	35	197		3	8
33	Woodworth, Selim Edward	At large	Sept. 30, 1873	15	5	12	46	51	44	37	31	5	20	239		6	24
20	Wright, Edward Everett	Massachusetts	Sept. 20, 1873	17	0	39	22	22	22	19	25	15	14	142		3	

CADET-MIDSHIPMEN, THIRD CLASS—RELATIVE STANDING. . 19

Third class—53 members.

Order of annual merit.	Name	State	Date of admission.	Age at date of admission.		Order of merit in—				No. of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English.	History.	French.		Months.	Days.
2	Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3	3	4	2	11	64	5	8
49	Bailey, Prentice	Kentucky	Sept. 28, 1874	17	1	49	52	61	41	146	3	0
13	Babb, Peyton Benajah	Alabama	June 12, 1874	17	3	11	17	30	11	119	3	0
15	Biddle, Spencer Fullerton Baird	At large	June 13, 1874	15	5	9	24	26	36	98	3	0
46	Cabeen, James Blake	Vermont	June 10, 1874	17	6	52	41	33	48	160	3	0
9	Candfield, William Chase	At large	Sept. 23, 1873	16	1	12	16	10	8	81	5	8
22	Carrington, Austin Downs	Virginia	Sept. 23, 1873	17	5	20	31	22	15	159	5	8
4	Castle, Mark Cheney	Minnesota	Sept. 29, 1873	16	9						3	8
17	Clark, George Ramsey	Ohio	June 9, 1874	17	3	17	20	13	30	134	3	0
39	Craven, John Eekleston	New Jersey	Sept. 24, 1874	15	10	31	54	60	30	138	3	0
50	Crosby, William	Texas	Sept. 25, 1874	16	11	51	59	57	52	140	3	0
40	Dent, Baine Canuthers	At large	June 5, 1873	16	7	37	36	49	44	246	5	8
38	Dickinson, Thomas	Kentucky	Sept. 24, 1874	16	5	42	28	41	17	228	3	0
36	Faulstich, Robert Powell	At large	Sept. 23, 1873	16	5	39	28	36	22	159	5	8
1	Fillmore, John Hudson	Illinois	Sept. 24, 1874	17	10	1	2	4	18	81	3	0
41	Garred, Charles Warren	Indiana	June 5, 1874	17	10	46	25	33	53	155	3	0
5	Glennon, James Henry	California	Sept. 24, 1874	17	7	2	8	16	4	137	3	0
32	Hall, William Edward Wyatt	Maryland	June 14, 1873	17	3	29	33	51	20	164	5	8
20	Hess, George Henry	Michigan	Sept. 23, 1873	17	7	13	36	29	27	147	3	0
24	Hetherington, James Henry	Iowa	June 9, 1874	17	7	20	43	30	62	148	3	0
52	Hodges, Fletcher	Georgia	June 5, 1872	16	8						3	8
7	Holcombe, John Hite Lee	At large	June 27, 1874	17	9	10	6	14	24	53	3	0

20 CADET-MIDSHIPMEN, THIRD CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN

Third class—53 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				No. of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English.	History.	French.		Months.	Days.
33	Hooker, Horatio Hill	Illinois	Sept. 26, 1874	17	0	27	49	30	46	293	3	0
10	Hughes, Richard Morris	Pennsylvania	Sept. 25, 1874	15	8	15	8	3	16	111	3	0
25	Huse, Harry McLaren Pinkney	New York	Sept. 30, 1874	15	10	38	17	15	1	100	3	0
35	Kinnell, Harry	Pennsylvania	Sept. 28, 1874	14	5	32	36	50	28	95	3	0
4	Knapp, Harry Shepard	Connecticut	June 26, 1874	18	0	4	1	7	14	166	3	0
31	Kuapp, John Joseph	Missouri	June 9, 1874	16	8	24	33	47	46	128	3	0
12	Lloyd, Edward, Jr.	Maryland	June 17, 1874	16	11	13	13	18	5	41	3	0
42	Mason, John Greene	Ohio	June 5, 1873	17	6	36	52	53	64	141	5	8
†	Machida, Keizero	Empire of Japan	Oct. 14, 1873	16	4						3	8
14	Mayer, Chester Alfred	New York	June 16, 1874	17	5	30	3	1	32	286	3	0
21	McClain, Charles Sumner	Indiana	Nov. 2, 1874	17	2	24	8	25	22	49	3	0
44	McDonnell, John Edmund	Nevada	Sept. 30, 1874	16	4	44	42	55	60	44	3	0
43	Poundstone, Homer Clarke	West Virginia	Sept. 24, 1874	14	0	46	36	45	41	38	3	0
26	Purcell, John Lewis	New Jersey	Sept. 29, 1873	17	4	27	43	50	58	140	5	8
6	Quibby, John Gardner	At large	June 12, 1874	14	10	5	12	9	19	182	3	0
3	Rodgers, Thomas Stidell	District of Columbia	Sept. 24, 1874	16	1	6	5	5	2	80	3	0
	Rodgers, William Ledyard	California	June 11, 1874	14	4	42	18	154	354	138		
47	Rogers, Allen Grey	North Carolina	June 12, 1874	14	6	48	35	55	49	210	3	0
48	Rowan, Andrew Summers	West Virginia	Sept. 25, 1874	17	5	52	50	33	51	148	3	0
7	Ryan, Thomas William	Pennsylvania	June 13, 1873	16	11	7	21	11	9	239	5	8
37	Shapley, John Harry	Missouri	Sept. 30, 1874	16	6	43	50	54	44	21	3	0
18	Skinner, Frank Gentry	Massachusetts	Sept. 30, 1874	17	0	36	11	6	91	47	3	0

Fourth class—118 members.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mo.
Aldrich, Stuart	California	Sept. 13, 1875	17	
Arima, Kantaro	Empire of Japan	June 4, 1874	17	
Arnold, John Powell	Alabama	June 21, 1875	17	
Bailey, John Bellamy	Florida	Sept. 15, 1875	16	
Baker, Henry Edwin, jr.	Mississippi	Sept. 24, 1874	17	
Barkley, Richard Warren	Missouri	June 19, 1875	16	
Barnard, Louis Hull	Colorado	June 13, 1874	16	
Bartlett, David	Missouri	Sept. 13, 1875	16	
Beale, Joseph	Pennsylvania	Oct. 12, 1874	14	
Bell, John Arthur	West Virginia	June 13, 1874	16	
Belmont, Oliver Hazard Perry ..	New York	Sept. 30, 1874	14	
Berkeley, Francis Louis	Virginia	Sept. 14, 1875	16	
Biddle, John Craig	Pennsylvania	Sept. 30, 1875	16	
Biller, Reuben Oscar	Pennsylvania	June 19, 1875	16	
Blish, John Bell	Indiana	Sept. 15, 1875	15	
Blish, Herbert	Rhode Island	Sept. 15, 1875	16	
Bonilla, Thomas Lewis	Missouri	June 19, 1875	17	
Boon, Howard County	Missouri	June 12, 1874	17	
Booth, Henry Driver	Delaware	Sept. 14, 1875	15	
Bowdon, Frank Welch	Texas	Sept. 11, 1875	17	
Boyd, John Platt	New York	Sept. 26, 1874	17	
Breckinridge, Robert Jefferson ..	Kentucky	Sept. 15, 1875	17	
Brown, Guy Warner	Indiana	June 19, 1875	17	
Brown, James Stephen	Tennessee	Sept. 11, 1875	17	
Buchanan, Wilson Wildman	Ohio	June 19, 1875	17	
Buffington, Anson Wilder	Iowa	Sept. 15, 1875	17	
Bullitt, Howard Henry	Kentucky	Sept. 11, 1875	17	
Chase, Henry Sanders	Louisiana	June 21, 1875	16	
Clements, Abner Brush	Missouri	June 21, 1875	17	
Cockle, Rudolphus Rouse	Illinois	June 21, 1875	17	
Cooke, Paul Byron	New York	Sept. 13, 1875	16	
Cooper, Robert John	Indiana	Sept. 13, 1875	17	
Cramer, Ambrose	Maryland	Sept. 28, 1874	17	
Cunningham, Andrew Charles	New York	June 9, 1874	16	
Dewey, Theodore Gibbs	At large	June 19, 1875	16	
Dougherty, John Allen	Missouri	June 19, 1874	16	
Drake, James Calhoun	Arkansas	June 19, 1875	17	
Drayton, Percival Langdon	New York	June 10, 1874	16	
Fillebrown, Horatio Ladd	South Carolina	June 19, 1875	16	
Finley, Henry Marzett	Ohio	June 21, 1875	16	
Fitzgerald, Edward Daniel	Maryland	Oct. 2, 1874	15	
Franklin, Thomas Baber	Tennessee	Sept. 15, 1875	17	
French, George Ross	At large	June 21, 1875	17	
Garrett, Leigh Osborn	New York	Sept. 13, 1875	15	
Garrett, LeRoy Mason	New York	Sept. 16, 1875	16	
Gibbons, John Henry	Michigan	Sept. 15, 1875	16	
Gibson, John	Kentucky	Feb. 16, 1874	18	
Gill, William Andrew	Pennsylvania	June 21, 1875	16	
Gilmore, Alexander Cattell	New Jersey	Sept. 15, 1875	16	
Gorgas, Miles Carpenter	Pennsylvania	Sept. 11, 1875	14	

Fourth class—112 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
William Alfred	New York	Sept. 25, 1874	14	11
nes	Illinois	Sept. 21, 1874	15	8
William Albert	Indiana	June 19, 1875	17	3
Henry Cargill	District of Columbia	June 26, 1875	17	7
Charles Henry	New York	Sept. 15, 1875	17	0
George Edward	Michigan	June 19, 1875	17	11
Alexander Ritchie	At large	June 21, 1875	15	4
Edward Everett	Illinois	June 21, 1875	16	2
d, Edgar Sanford Wilson	Virginia	Sept. 14, 1875	11	6
cles Homer	Wisconsin	Sept. 14, 1875	16	0
hn	Alabama	Sept. 15, 1875	15	9
l, Fitz-Aubert	Texas	Sept. 15, 1875	16	10
Washington	New York	Sept. 14, 1875	15	0
Samuel LeRoy	Virginia	Sept. 14, 1875	16	10
l, Campbell Moore	Ohio	Sept. 13, 1875	15	10
Richard	New Jersey	June 19, 1875	16	11
Charles William	Wisconsin	Sept. 24, 1874	15	6
Francis Woodruff	Connecticut	June 21, 1875	17	10
Edward Fenno	South Carolina	June 21, 1875	15	7
William Nephew, jr.	Georgia	June 21, 1875	17	5
Edwards Fayssoux	Pennsylvania	June 21, 1875	16	7
Leonidas	Louisiana	June 21, 1875	17	6
Robert Files	Tennessee	Sept. 29, 1874	17	6
ohn Frazer	New York	June 21, 1875	17	11
Charles Carleton	Indiana	Sept. 14, 1875	17	1
William O'Neil Perkins	Tennessee	Sept. 13, 1875	16	6
l, William John	At large	June 9, 1874	15	2
Frederick Parkhouse	North Carolina	Sept. 25, 1874	16	3
Daniel Preston	California	Sept. 25, 1874	16	6
Randolph Huntington	Ohio	June 19, 1875	15	7
ohn McConnell	Indiana	June 21, 1875	17	6
Alfred George	Louisiana	Sept. 25, 1874	16	11
William	New York	Sept. 15, 1875	17	11
ohn Alexis	Missouri	Sept. 11, 1875	15	3
Salvin Columbus Jackson	Idaho Territory	Sept. 15, 1875	17	8
ll, James	Maine	Sept. 13, 1875	17	5
Edward Hilton	District of Columbia	June 23, 1875	15	5
ward Otto Cresp	Nebraska	Sept. 13, 1875	16	10
Frank Bailey	Massachusetts	Sept. 15, 1875	17	6
Alfred Noble	Ohio	Sept. 24, 1874	17	4
Con Marrast	Georgia	Sept. 11, 1875	14	11
ohn Pryor	Texas	Sept. 11, 1875	16	2
George Henry Rittenhouse	At large	Sept. 28, 1874	15	2
aurice Lance	South Carolina	Sept. 28, 1874	15	10
Joseph Louis	At large	July 13, 1874	17	11
Charles Stebbins	At large	June 15, 1875	17	11
n, Herbert Johnson	New Hampshire	Sept. 15, 1875	16	6
Hugh	Kentucky	Sept. 13, 1875	16	8
William Worthington	Maryland	Sept. 14, 1875	16	9

CADET-MIDSHIPMEN.

Fourth class—118 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mon.
Saunders, Nat.....	Texas.....	June 11, 1873	15	11
Schrum, James Albert.....	Illinois.....	Sept. 14, 1873	16	2
Schwerin, Rennie Pierre.....	New York.....	Sept. 25, 1874	16	1
Scott, George Andrew.....	Indiana.....	June 21, 1873	17	3
Sears, Walter Jesse.....	Pennsylvania.....	June 21, 1873	17	3
Sloan, Robert Sage.....	New York.....	June 21, 1873	15	7
Snowden, Thomas.....	New York.....	June 21, 1873	17	13
Starkloff, Emile Arthur von.....	Missouri.....	July 31, 1875	17	11
Sturdevant, Harry Leland.....	Maine.....	June 13, 1874	17	5
Swift, Franklin.....	Massachusetts.....	June 9, 1874	16	1
Thom, William Arthur.....	At large.....	June 21, 1873	17	3
Thompson, Edward Clinton.....	Pennsylvania.....	Sept. 13, 1873	17	3
Tillmann, Edwin Hord.....	Tennessee.....	Sept. 14, 1873	16	11
Webster, Edwin Beiden.....	Connecticut.....	Sept. 28, 1874	16	6
Welsh, George Silvis.....	Pennsylvania.....	Sept. 24, 1874	17	7
Wike, Harvey.....	Illinois.....	Sept. 16, 1873	14	7
Wilkinson, Ernest.....	Louisiana.....	June 19, 1873	17	3
Winchester, William Simpson.....	Indiana.....	Aug. 10, 1873	18	3
Woodworth, Frederick Augustus.....	California.....	June 12, 1873	16	5

CADET-ENGINEERS.

Graduating class, 1875—16 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Sea service in practice-ships.		
				Years.	Months.	Steam.	Electricity.	Chemistry.	Heat.	Applied mathematics.	French.	No. of days.	Months.	Days.
*1	Bailey, Frank Hughes	Pa	Oct. 1, 1873	22	3	1	3	3	2	1	16	0	3	0
*2	Cowles, William	N. Y. ..	Oct. 1, 1873	18	7	2	2	5	7	2	13	12	3	0
*3	Willitts, George Sidney	Pa	Oct. 1, 1873	20	6	3	6	7	9	2	5	1	3	0
*4	Cathcart, William Ledyard	Conn ..	Oct. 1, 1873	18	1	4	3	4	5	7	4	21	3	0
*5	Worthington, Walter Fitzhugh	Md ...	Oct. 1, 1873	18	6	8	11	1	10	2	1	1	3	0
6	Little, William Nelson, Jr.	Ga	Oct. 1, 1872	19	8	6	4	9	11	11	11	71	6	5
7	Warburton, Edgar Townsend	Pa	Oct. 1, 1872	17	3	8	8	2	1	5	3	3	3	0
8	Burgdorff, Theodore Frederick	N. J. ...	Oct. 1, 1873	18	9	10	1	13	4	2	6	48	3	0
9	King, William Richard	Md ...	Oct. 1, 1872	19	9	13	12	16	10	4	12	80	6	3
10	Freeman, Edward Russell	Miss ..	Oct. 1, 1873	19	9	12	10	12	6	13	7	46	3	0
11	Babbitt, George Henry Thomas	Ohio ..	Oct. 1, 1873	17	2	11	9	10	13	6	8	86	3	0
12	Eldridge, Frank Harold	Ohio ..	Oct. 1, 1872	20	2	5	6	10	12	14	15	3	6	5
13	Kleckner, Charles	Pa	Oct. 1, 1871	18	7	14	14	8	3	12	14	52	6	5
14	De Ruiz, Alberto	Pa	Oct. 1, 1873	20	5	16	15	15	16	15	1	128	2	0
15	Loomis, Edmund Underwood	Md ...	Oct. 1, 1872	21	3	13	12	14	15	9	10	43	3	0
16	Boggs, William Brenton	D. C. ..	Oct. 1, 1871	19	11	7	16	6	14	13	2	52	6	5

†Graduated September, 1875.

CADET-ENGINEERS.

First class—3 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—			No. of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Stem.	French.		Months.	Days.
1	Dunning, William Batey.....	N. Y.	Oct. 1, 1873	19	2	1	1	2	46	3	9
2	Reid, Robert Ingersoll	Pa.	Oct. 1, 1872	20	2	2	3	1	63	3	9
3	Stivers, Henry Hicks	N. Y.	Oct. 1, 1873	18	0	3	2	3	31	3	9

CADET-ENGINEERS.

Third class—17 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				No. of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Grammar.	History and composition.	French.		Months.	Days.
1	Bartlett, Frank William	Mich.	Oct. 1, 1874	18	1	6	4	6	3	113	2	9
2	Big, Frederick Charles.....	Mo.	Oct. 1, 1874	18	0	12	14	10	4	31	2	9
3	Bell, Gould Hoyt.....	Pa.	Oct. 1, 1874	18	4	3	9	7	5	115	2	9
4	Burt, George Eli	Mass.	Oct. 1, 1874	17	5	20	15	21	20	56	2	9
5	Cooley, Mortimer Elwyn.....	N. Y.	Oct. 1, 1874	19	6	9	13	17	9	65	2	9
6	Dungas, Horace Greeley....	Iowa	Oct. 1, 1874	20	6	17	21	20	14	38	2	9
7	Gage, Howard	Mich.	Oct. 1, 1874	18	1	7	6	2	10	41	2	9
8	Gow, John London	Ind.	Oct. 1, 1874	18	4	10	6	16	19	68	2	9
9	Griffin, Robert Stanislaus ..	Va.	Oct. 1, 1874	17	0	8	12	18	6	43	2	9
10	Hollis, Ira Nelson	Ky.	Oct. 1, 1874	18	6	1	1	1	1	34	2	9
11	Ivers, Henry King.....	Mo.	Oct. 1, 1874	18	6	16	8	3	16	9	2	9
12	McElroy, George Wightman	Mich.	Oct. 1, 1874	16	6	5	10	9	13	136	2	9
13	Pickrell, Joseph McCall.....	Va.	Oct. 1, 1874	17	2	11	19	13	12	105	2	9
14	Schell, Franklin Jacob ..	Pa.	Oct. 1, 1874	17	1	2	4	5	8	6	2	9
15	Spangler, Harry Wilson....	Pa.	Oct. 1, 1874	16	9	4	3	11	11	56	2	9
16	Wright, Charles Leslie	Mass.	Oct. 1, 1874	21	1	13	11	4	7	8	2	9
17	Wilmer, Joseph Ringgold....	Md.	Oct. 1, 1874	20	10	14	2	8	2	37	2	9

Fourth class—28 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing determined at examination.
			Years.	Months.	
Acker, Edward O'Connor	Pennsylvania	Sept. 15, 1875	17	4	
Annan, John Wesley	Massachusetts	Sept. 15, 1875	19	0	
Baker, John Howard	Rhode Island	Sept. 15, 1875	18	0	
Bartholow, Frank La Motte	Ohio	Sept. 15, 1875	18	8	
Bennett, Frank Marion	Michigan	Oct. 1, 1874	17	5	
Bevington, Martin	Ohio	Sept. 15, 1875	17	10	
Bowles, Francis Tiffany	Massachusetts	Sept. 15, 1875	16	11	
Bowers, Frederick Clay	New Jersey	Sept. 15, 1875	17	7	
Bryan, Benjamin Chambers	New Jersey	Sept. 15, 1875	17	1	
Carr, Clarence Alfred	Pennsylvania	Sept. 15, 1875	19	1	
Crygier, John Ulysses	New York	Oct. 1, 1874	16	6	
Elseffer, Harry Smith	Iowa	Oct. 1, 1874	19	3	
Gatewood, Richard	Virginia	Sept. 15, 1875	15	11	
Harrison, Henry Fillmore	Maryland	Oct. 1, 1874	18	9	
Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10	
Hunt, Andrew Murray	Indiana	Sept. 15, 1875	16	2	
Isbester, Richard Thornton	Tennessee	Sept. 15, 1875	18	3	
Lubbe, Charles Bethel	Pennsylvania	Sept. 15, 1875	18	3	
McFarland, Walter Martin	District of Columbia	Sept. 15, 1875	16	1	
Mercier, David Isaiah	Virginia	Sept. 15, 1875	19	1	
Noell, Michael Daniel	Pennsylvania	Sept. 15, 1875	17	5	
Norton, Harold Percival	New York	Oct. 1, 1874	18	10	
Salisbury, George Robert	Mississippi	Oct. 1, 1874	19	7	
Scribner, Edward Herschell	Massachusetts	Oct. 1, 1874	19	11	
Smith, William Strother	Virginia	Sept. 15, 1875	18	0	
Talcott, Charles Gratiot	Virginia	Sept. 15, 1875	16	0	
Temple, Arthur Wallace	Massachusetts	Sept. 15, 1875	20	9	
Yarnall, John Hepburn	District of Columbia	Sept. 15, 1875	19	1	

SUMMARY.

Academic year 1875-76.

CADET-MIDSHIPMEN.

First class	42 members.
Second class	61 members.
Third class	53 members.
Fourth class	118 members.

CADET-ENGINEERS.

First class	3 members.
Third class	17 members.
Fourth class	28 members.

Total

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States, approved July 27, 1863.

RESIGNATIONS, DISMISSALS, AND DEATHS.

RESIGNATIONS.

Cadet-Midshipman A. B. Frenzel.....	Jan.	11, 1875
Cadet-Midshipman T. N. Wood.....	Feb.	4, 1875
Cadet-Midshipman J. H. Dykeman.....	Feb.	12, 1875
Cadet-Midshipman E. R. Poland.....	Feb.	26, 1875
Cadet-Midshipman William Green.....	Mar.	2, 1875
Cadet-Midshipman S. L. Blodgett.....	Mar.	25, 1875
Cadet-Midshipman P. O. Conger.....	Mar.	25, 1875
Cadet-Midshipman C. W. Horton.....	April	10, 1875
Cadet-Midshipman S. M. Peacock.....	May	11, 1875
Cadet-Midshipman J. A. Perry.....	June	1, 1875
Cadet-Midshipman F. H. Duer.....	June	12, 1875
Cadet-Midshipman T. B. Maynadier.....	June	22, 1875
Cadet-Midshipman D. Bartlett.....	June	22, 1875
Cadet-Midshipman L. E. Cummings.....	June	22, 1875
Cadet-Midshipman A. G. Gray.....	June	22, 1875
Cadet-Midshipman A. B. Guinnip.....	June	22, 1875
Cadet-Midshipman A. J. Maury.....	June	22, 1875
Cadet-Midshipman W. W. Picking.....	June	22, 1875
Cadet-Midshipman Sam Richardson.....	June	22, 1875
Cadet-Midshipman B. W. Taylor.....	June	22, 1875
Cadet-Midshipman E. H. Tillman.....	June	22, 1875
Cadet-Midshipman L. V. Wilson.....	June	22, 1875
Cadet-Midshipman O. J. Schoolcraft.....	Aug.	10, 1875
Cadet-Midshipman F. L. Godfrey.....	Aug.	24, 1875
Cadet-Midshipman E. C. Condict.....	Sept.	4, 1875
Cadet-Midshipman P. S. Buckley.....	Sept.	14, 1875

WITHDRAWN.

Japanese student Hidemaro Nambu.....	Jan.	5, 1875
--------------------------------------	------	---------

DISMISSALS.

Cadet-Midshipman John D. Chase, dropped.....	Oct.	10, 1874
Cadet-Midshipman B. W. Parker, dropped.....	Oct.	10, 1874
Cadet-Midshipman George Van Horne, dropped.....	Jan.	5, 1875
Cadet-Midshipman George E. Perry, dropped.....	Mar.	10, 1875
Cadet-Midshipman John Hood, dismissed.....	Feb.	10, 1875
Cadet-Midshipman Lawson D. Melton, dismissed.....	Feb.	10, 1875
Cadet-Engineer Gordon H. Claude, dismissed.....	Feb.	23, 1875
Cadet-Midshipman Charles R. Breck, dismissed.....	Jan.	26, 1875
Cadet-Midshipman Wilson L. Todd, dismissed.....	July	23, 1875
Cadet-Engineer Henry O'Connor, dropped.....	Oct.	4, 1875

DEATHS.

Cadet-Midshipman Carshena Wallace.....	Dec.	23, 1874
Cadet-Midshipman William H. Cox.....	April	14, 1875
Cadet-Midshipman Mark Bridgers.....	July	9, 1875

SUMMER-CRUISE, 1875.

REAR-ADMIRAL C. R. P. RODGERS, COMMANDING SQUADRON.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION

Commander EDWARD TERRY, *Commanding.*
Lieutenant-Commander C. M. CHESTER, *Executive Officer.*
Lieutenant-Commander S. H. BAKER, *Navigator.*
Lieutenant C. S. SPERRY, *Senior Watch-Officer.*
Lieutenant S. A. SIMONS, *Watch-Officer.*
Lieutenant E. P. WOOD, *Watch-Officer.*
Lieutenant C. C. CORNWELL, *Watch-Officer.*
Lieutenant R. P. RODGERS, *Instructor in Navigation.*
Lieutenant J. B. BRIGGS, *Watch-Officer.*
Chaplain J. R. MATTHEWS.
Paymaster EDWARD MAY.
Surgeon T. N. PENROSE.
Assistant Surgeon J. C. BOYD.
Boatswain ANDREW MILNE.
Gunner ROBERT SOMMERS.
Clerk to Commandant of Cadets, C. M. McLEOD.
Paymaster's Clerk, W. H. ROACH.

CADET-MIDSHIPMEN.

First class (42).

W. H. Allen.	J. C. Gilmore.	W. McLean.	A. W. Rollins.
C. J. Boush.	C. A. Gove.	H. Minett.	W. D. Rose.
W. Braunersreuther.	T. D. Griffin.	R. T. Mulligan.	J. H. Sears.
S. J. Brown.	W. G. Hannum.	J. T. Newton.	F. H. Sherman.
D. R. Case.	R. Henderson.	L. W. Piepmeyer.	Benjamin Tappan.
W. J. Chambers.	W. S. Hogg.	C. F. Pond.	W. L. Varnum.
D. W. Coffman.	A. E. Jardine.	T. M. Potts.	B. T. Walling.
A. E. Culver.	S. Jenkins.	J. M. McL. Prondit.	T. G. Winch.
E. N. Fisher.	E. M. Katz.	R. C. Ray.	E. E. Wise.
G. E. Foulk.	S. B. Mallory.	L. K. Reynolds.	
H. C. Gearing.	H. T. Mayo.	C. C. Rogers.	

Second class (1).

N. J. L. T. Halpine.

Third class (50).

C. N. Atwater.	J. H. Fillmore.	E. Lloyd.	F. C. Skinner.
P. Baily.	C. W. Garrett.	J. G. Mason.	R. C. Smith.
P. B. Bibb.	J. H. Glennon.	C. A. Mayer.	G. Sparhawk.
S. F. B. Biddle.	W. E. W. Hall.	C. S. McClain.	F. J. Sprague.
J. B. Cahoon.	G. H. Hess.	J. E. McDonnell.	G. H. Stafford.
W. C. Canfield.	J. H. Hetherington.	H. C. Poundstone.	W. L. Todd.
A. D. Carrington.	J. H. L. Holcombe.	J. L. Parcell.	A. B. Tracy.
G. E. Clark.	H. H. Hooke.	J. G. Quinby.	L. H. Webb.
J. E. Craven.	R. M. Hughes.	T. S. Rodgers.	W. P. White.
William Crosby.	H. McL. P. Huse.	A. G. Rogers.	R. R. Wright.
B. C. Dent.	H. Kimwell.	A. S. Rowan.	F. L. Young.
T. Dickinson.	H. S. Knapp.	O. J. Schoolcraft.	
R. P. Fauntleroy.	J. J. Knapp.	J. H. Shipley.	

Sailed from Annapolis Roads June 26; touched at Hampton Roads; proceeded thence to Buzzard's Bay, Mass.; touched at New Bedford; afterward at Newport, R. I., and visited the Torpedo Station; thence for the Chesapeake; and arrived at the Naval Academy September 17, 1875.

UNITED STATES PRACTICE-STEAMER ALERT.

Commander W. T. SAMPSON, *Commanding.*

Lieutenant-Commander O. F. HEYERMAN.

Lieutenant J. C. RICH.

Lieutenant A. V. WADHAMS.

Lieutenant W. H. EVERETT.

Master F. E. UPTON.

Ensign W. P. ELLIOTT.

Passed Assistant Surgeon H. M. MARTIN.

Assistant Paymaster W. W. BARRY.

Chief Engineer A. H. ABLE.

Passed Assistant Engineer J. L. D. BORTHWICK.

Assistant Engineer C. W. RAE.

Acting Boatswain N. P. GRACE.

Paymaster's Clerk, I. T. VAN PATTEN.

Acting Carpenter, J. S. WALTERMEYER.

CADET-ENGINEERS.

Third class (17).

F. W. Bartlett.	H. G. Dungan.	J. H. Hollis.	F. J. Schell.
F. C. Bieg.	H. Gage.	H. K. Ivers.	H. W. Spangler.
G. H. Bull.	J. L. Gow.	G. W. McElroy.	C. L. Wight.
G. E. Burd.	R. S. Griffin.	J. M. Pickrell.	J. A. Wilmer.
M. E. Cooley.			

Left her anchorage September 29; proceeded to Norfolk, Va.; touched at the navy-yard; thence to Wilmington and Edgemoor, Del.; Chester and Philadelphia, Pa.; Williamsburgh and the navy-yard, New York; Newport, R. I.; touched at Rocky Point, and visited Providence, R. I.; thence to New Bedford and Boston, where the officers and cadets belonging to the Academy were detached September 2, and the ship assigned to other service.

Table of coefficients to be applied to the final averages in each branch in preparing the merit rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Co-efficients.				Graduating maximum for required studies
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship.....	Seamanship.....			3	12	112
	Ship-Building.....			4		
	Naval Tactics.....			4		
	Naval Architecture.....			6		
Ordnance and Gunnery	Practical Exercises.....			5		72
	Ordnance-Instructions.....			4		
	Infantry Tactics.....			2		
	Ordnance and Armor.....			13		
Mathematics.....	Algebra and Geometry.....	9				120
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		12			
Steam-Engineering.....	Marine Engines.....				11	4
	General Astronomy.....			6		
Astronomy, Navigation, and Surveying.....	Navigation and Surveying.....				13	120
	Chemistry and Physics.....		8			
Physics and Chemistry	Applied Mathematics and Mechanics.....			14		120
	Electricity.....			6		
	Light and Heat.....				2	
English Studies, History, and Law.....	English and History.....	6				120
	History and Rhetoric.....		6			
	Composition.....			5		
Modern Languages.....	Public Law.....				3	120
	French.....	2	4	4		
Drawing.....	Spanish.....			3	3	16
	Line-Drawing and Topography.....	2				
	Sketching.....		2			
Maximum for each year.....		76	152	228	304	768
Deduction for each demerit.....		.004	.007	.013	.03	

CADET-ENGINEERS.

Seamanship.....	Ship-Building.....			4		48
	Naval Architecture.....				6	
Mathematics.....	Algebra and Geometry.....	9				120
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		12			
Steam-Engineering.....	Mechanical Drawing.....	2	2			120
	Fabrication of Machinery.....			21	35	
Astronomy, Navigation, and Surveying.....	Designing of Machinery.....					24
	Marine Engines.....					
Physics and Chemistry	General Astronomy.....				6	24
	Physics and Chemistry.....		2			
Physics and Chemistry	Applied Mathematics and Mechanics.....			14		24
	Electricity.....			6		
	Mechanics.....				2	
English Studies, History, and Law.....	Light and Heat.....					24
	Physical Measurements.....				7	
	English and History.....	6				
Modern Languages.....	History and Rhetoric.....		6			24
	Composition.....			5		
Modern Languages.....	Public Law.....				3	24
	French.....	2	4	4		
	Spanish.....			3	3	24
Maximum for each year.....		76	152	228	304	768
Deduction for each demerit.....		.004	.007	.013	.03	

MERIT-ROLLS FOR 1874-75.

Merit-rolls, made out yearly for each class, show the proficiency of the Cadets in each branch of study. Hereafter, the numbers given in the table, showing the relative weight of the different branches, will be used as co-efficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the Cadet for the year.

In the case of Cadets who take an elective course in any branch, the final mark in that branch is to be determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 250.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

The merit-rolls for the year ending June, 1875, were made by the method described in the last Academy Register.

Cadets whose names are marked thus (*) are the five most distinguished in their respective classes.

Those marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

a denotes absence from examination.

CADET-MIDSHIPMEN.
Merit-roll of first class (32 members), annual examination, June, 1875, and general merit-roll for four years.

Order of general merit.	Name.	Seamanship.	Practical exercises.	Naval architecture.	Gunnery.	Boatwork.	Marine engines, boilers, &c.	Astronomy and navigation.	Heat and climatology.	Optics and acoustics.	International law.	Spanish.	Conduct.	Average for fourth year.	Average for third year.	Average for second year.	Average for first year.	General aggregate for four years.
1	Maxima	120	51	36	84	9	84	153	45	30	30	30	210	882	681	526	255	2344
2	Albon C. Hodgson	107.10	45.53	36.00	82.13	6.20	84.00	153.00	45.00	30.00	30.00	30.00	198.45	847.49	623.05	496.14	250.67	2287.35
3	Charles H. A. Gordon	99.35	51.00	31.25	74.67	6.20	78.58	116.81	30.00	31.54	17.10	28.00	196.98	754.44	614.23	431.22	2042.13	2042.13
4	James M. Winslow	100.68	40.61	35.83	60.97	8.81	82.61	133.84	34.66	34.62	34.84	32.36	204.54	700.77	614.78	398.01	146.88	1950.41
5	William G. Holt	100.09	44.63	32.80	64.40	4.84	82.19	149.71	42.93	36.15	37.42	34.19	190.05	812.17	506.72	403.78	166.55	1890.42
6	William G. Cutler	101.94	40.63	30.58	72.40	4.84	82.19	149.71	42.93	36.15	37.42	34.19	190.05	812.17	506.72	403.78	166.55	1890.42
7	Clarence A. Corbin	112.96	42.77	34.08	72.80	7.03	84.13	110.53	35.34	33.47	32.26	33.23	185.43	723.63	522.42	388.37	203.91	1838.33
8	Fydelio S. Carter	117.49	40.35	13.45	67.90	6.03	80.01	90.48	13.97	19.23	32.71	16.77	203.49	700.94	501.47	397.07	219.45	1818.73
9	Fredrick W. Coffin	114.84	34.35	58.85	67.90	4.28	73.87	146.42	43.97	33.62	30.35	36.77	183.75	703.60	506.37	431.95	150.60	1811.92
10	Harry H. Hooley	94.19	39.06	32.13	48.53	4.49	83.65	102.00	37.93	35.98	31.61	15.16	191.94	677.18	572.09	412.75	136.07	1798.69
11	Charles Leih	85.16	41.98	32.84	70.53	4.97	83.16	116.81	32.59	36.92	17.10	19.08	204.75	638.35	584.19	441.72	176.48	1809.57
12	Walter S. Hughes	87.74	31.44	33.16	48.53	4.97	83.16	116.81	32.59	36.92	17.10	19.08	204.75	638.35	584.19	441.72	176.48	1809.57
13	Nathaniel R. Usher	85.16	34.35	17.42	53.97	6.87	71.35	106.94	20.17	13.85	13.16	13.87	205.38	623.18	499.31	449.90	137.68	1710.07
14	Harry M. Hodges	54.19	31.26	36.32	48.53	3.39	56.00	125.03	33.28	30.77	18.39	18.39	194.67	598.59	564.33	318.41	212.71	1694.04
15	Frank F. Fletcher	53.61	33.41	34.06	41.07	6.82	65.94	135.03	38.26	32.31	26.13	27.43	204.80	725.92	624.74	354.76	134.52	1657.94
16	David Daniels	104.22	37.84	34.06	41.07	6.82	65.94	135.03	38.26	32.31	26.13	27.43	204.80	725.92	624.74	354.76	134.52	1657.94
17	Alexander Sharp	50.32	37.84	34.06	41.07	6.82	65.94	135.03	38.26	32.31	26.13	27.43	204.80	725.92	624.74	354.76	134.52	1657.94
18	Monas L. Wood	50.32	37.84	34.06	41.07	6.82	65.94	135.03	38.26	32.31	26.13	27.43	204.80	725.92	624.74	354.76	134.52	1657.94
19	Richard H. Twenley	62.31	34.08	37.45	64.00	7.45	80.39	129.97	30.93	30.00	18.07	14.22	193.20	598.52	440.59	362.36	198.53	1692.52
20	Edward D. Bostick	61.10	37.84	30.73	60.73	6.28	62.32	74.03	31.21	16.92	15.81	14.22	193.20	598.52	440.59	362.36	198.53	1692.52
21	George H. Worcester	47.58	31.94	22.06	76.53	3.71	40.65	143.13	40.86	25.46	11.29	13.81	180.29	671.98	478.17	343.74	215.10	1558.57
22	John A. Shumaker	72.53	32.35	12.77	56.13	7.84	68.65	143.13	40.86	25.46	11.29	13.81	180.29	671.98	478.17	343.74	215.10	1558.57
23	Frank E. Barty	78.71	29.06	19.74	53.07	3.19	51.46	133.26	35.89	22.23	11.29	13.81	180.29	671.98	478.17	343.74	215.10	1558.57
24	Robert M. Doyle	96.32	18.10	54.30	33.60	4.74	46.06	87.19	33.26	22.23	11.29	13.81	180.29	671.98	478.17	343.74	215.10	1558.57
25	Charles T. Smith	54.19	21.94	18.97	50.73	3.40	46.06	87.19	33.26	22.23	11.29	13.81	180.29	671.98	478.17	343.74	215.10	1558.57
26	Charles T. Smith	54.19	21.94	18.97	50.73	3.40	46.06	87.19	33.26	22.23	11.29	13.81	180.29	671.98	478.17	343.74	215.10	1558.57
27	Alfred L. Howe	81.29	25.77	13.35	37.33	3.07	56.00	64.16	31.35	11.15	10.65	10.65	192.70	543.46	408.41	300.89	148.14	1392.96
28	Henry J. Hunt	96.77	42.77	18.19	39.87	8.42	47.87	60.87	31.35	11.15	10.65	10.65	192.70	543.46	408.41	300.89	148.14	1392.96
29	Frank R. Collins	42.16	17.00	29.81	52.47	6.58	37.94	67.43	17.39	8.46	10.65	10.65	192.70	543.46	408.41	300.89	148.14	1392.96
30	Rudolf Hunt	72.53	43.35	12.00	35.47	6.10	31.61	65.94	17.39	8.46	10.65	10.65	192.70	543.46	408.41	300.89	148.14	1392.96
31	Frederick E. Vinton	67.10	39.87	16.65	39.90	5.23	42.43	55.94	12.03	7.69	13.87	13.87	193.20	598.52	440.59	362.36	198.53	1692.52
32	William D. Espartero	77.59	27.84	18.49	42.93	5.23	42.43	55.94	12.03	7.69	13.87	13.87	193.20	598.52	440.59	362.36	198.53	1692.52
33	George H. Worcester	80.32	34.35	14.23	31.23	5.13	46.00	51.99	15.00	6.15	13.87	13.87	193.20	598.52	440.59	362.36	198.53	1692.52

Merit-roll of second class (47 members), annual examination, June, 1975.

Rank	Name.	Score of annual merit.										Aggregate.		
		Seamanship.	Naval tactics.	Ship-building.	Gunnery.	Infantry tactics.	Fencing.	Astronomy.	Magnetism and elec- tricity.	Applied mathematics.	English composition.		French.	Drawing.	Conduct.
		99	24	21	45	30	8	45	45	120	30	60	30	120
1	Maximo													
2	Stimson J. Brown	84.53	17.91	23.64	45.00	26.41	7.01	41.21	41.30	118.00	25.56	50.00	27.14	105.96
3	George C. Fouk	95.53	23.65	22.15	42.91	26.00	7.01	39.87	40.12	109.00	25.56	50.00	26.07	111.43
4	Henry C. Gearing	90.93	18.74	29.91	42.91	29.74	6.91	45.00	45.00	120.00	24.99	53.63	19.53	105.43
5	Burns F. Walling	88.73	12.72	22.55	45.00	22.67	3.72	33.95	41.31	104.00	26.00	54.14	19.72	104.16
6	Templin M. Potts	96.07	14.61	24.00	42.91	28.41	7.30	42.91	34.53	106.00	12.00	57.27	10.34	104.16
7	William H. Allen	94.60	22.96	21.45	41.51	29.74	7.54	43.49	32.91	102.00	21.74	47.27	16.00	115.14
8	Stephen Jenkins	93.60	15.83	23.27	36.63	28.41	4.87	37.89	35.23	81.00	24.28	51.26	14.52	108.24
9	Henry T. Mayo	71.87	13.71	18.73	36.62	28.41	3.30	41.05	42.21	112.00	15.33	33.45	17.41	108.14
10	Edward M. Katz	71.87	13.71	18.73	36.62	28.41	3.30	41.05	42.21	112.00	15.33	33.45	17.41	108.14
11	Charles C. Rogers	50.60	22.61	20.91	23.62	21.33	7.74	38.62	38.62	111.00	20.00	33.36	13.77	106.30
12	Clifton J. Boush	90.93	19.13	22.91	36.86	26.81	5.77	37.63	32.71	94.00	16.29	43.18	23.41	112.50
13	James H. Sears	63.40	16.00	16.55	33.84	25.26	8.00	34.74	36.72	100.00	12.20	40.00	28.23	104.72
14	Thomas G. White	57.50	22.26	16.00	35.33	25.26	9.00	30.30	30.00	81.00	22.41	40.00	28.23	104.72
15	Abraham E. Culver	36.67	20.17	13.11	33.84	13.11	4.37	39.87	33.49	116.00	26.67	54.55	22.95	112.92
16	Richard Henderson	72.00	17.43	14.00	40.17	19.11	6.33	35.11	23.45	96.00	21.74	45.00	30.40	105.66
17	Augustus E. Jarline	81.40	18.49	9.61	35.93	21.67	7.96	16.54	25.26	92.00	13.33	32.23	21.43	105.00
18	Walter K. Reynolds	99.00	19.15	20.15	34.75	26.44	4.64	34.30	30.00	77.00	16.49	37.61	13.57	107.32
19	William L. Vannu	77.27	20.27	17.45	33.14	23.74	7.12	35.23	37.01	81.00	24.22	31.25	21.30	107.32
20	Charles F. Pond	74.67	21.01	15.82	32.69	18.45	3.72	35.23	37.01	81.00	24.22	31.25	21.30	107.32
21	Albert W. Rios	55.00	15.40	15.61	32.69	18.45	3.72	35.23	37.01	81.00	24.22	31.25	21.30	107.32
22	Robert J. Ray	52.87	12.92	15.61	31.92	20.35	3.91	29.21	31.16	107.00	16.22	31.25	21.30	107.32
23	William D. Rose	65.93	16.77	14.00	29.42	20.35	3.91	29.21	31.16	107.00	16.22	31.25	21.30	107.32
24	John T. Newton	43.25	14.96	21.82	27.91	20.35	5.51	26.74	17.11	77.00	16.49	37.27	22.40	116.04
25	Stevenson B. Mallory	43.25	10.74	12.36	18.49	17.74	6.15	30.32	34.49	62.00	25.43	60.00	13.57	104.16
26	Richard F. Mulligan	71.87	11.44	7.25	29.30	19.11	3.13	36.32	27.47	41.00	28.64	53.33	23.21	103.36
27	James G. Lenore	70.24	9.71	13.09	24.12	19.11	3.00	32.40	31.74	41.00	10.78	33.61	23.21	103.36
28	William G. Hennum	70.24	9.71	13.09	24.12	19.11	3.00	32.40	31.74	41.00	10.78	33.61	23.21	103.36
29	Benjamin F. Dean	57.93	11.13	14.91	21.42	15.43	4.22	22.11	23.37	64.00	27.78	38.18	13.57	99.12
30	De Witt Coffman	41.80	12.62	19.27	32.09	12.22	2.25	21.32	31.65	66.00	11.33	30.91	17.40	110.64

Cadet-midshipmen—Merit-roll of second class—Continued.

Order of annual merit.	Name.	Seamanship.	Naval tactics.	Ship-building.	Gunnery.	Infantry tactics.	Penciling.	Astronomy.	Magnetism and electricity.	Applied mathematics.	English composition.	French.	Drawing.	Conduct.	Aggregate.
	Maxima.....	69	24	24	45	30	9	45	45	120	30	60	30	120	684
31	Charles A. Gove.....	48.40	9.04	13.45	95.61	10.44	5.35	32.37	39.42	60.00	12.20	28.64	18.81	100.32	413.94
32	Francis H. Sherman.....	36.67	16.87	12.73	97.91	92.01	6.00	42.84	93.57	53.00	15.33	26.87	20.95	101.08	408.42
33	Daniel R. Case.....	36.47	21.23	17.09	19.19	91.11	6.13	23.68	31.74	46.00	15.33	36.36	15.94	96.84	406.40
34	William S. Hogg.....	79.80	13.47	10.91	25.41	9.56	8.48	17.37	17.44	69.00	17.50	36.36	15.95	104.52	403.59
35	Henry Minott.....	69.13	29.17	11.42	21.89	14.22	7.59	24.47	19.53	53.00	13.56	43.18	16.90	96.36	402.19
36	Edward R. Wither.....	36.67	12.53	9.64	17.09	10.10	4.63	15.79	16.40	55.00	29.11	48.18	20.52	109.44	396.99
37	Elliot S. Wabber.....	46.90	8.70	18.23	23.02	13.56	7.20	19.74	30.63	53.00	69.69	23.87	20.48	96.84	399.76
38	John M. Proudhon.....	68.03	16.25	11.97	16.40	16.89	3.36	12.55	14.30	41.00	18.22	30.00	24.52	104.88	371.97
39	Washington J. Chambers.....	68.73	39.17	10.18	15.10	16.89	8.61	13.42	18.49	79.00	23.74	45.00	27.62	108.06	446.85
40	Louis W. P. Sawyer.....	48.40	14.26	10.55	50.58	21.56	4.37	14.91	25.81	44.00	29.56	52.73	11.43	101.76	399.22
41	Thomas D. Griffin.....	26.67	15.83	8.73	19.89	16.09	4.96	12.63	27.91	38.00	23.33	51.36	13.57	103.44	371.77
42	William F. Waltersworth.....	68.03	18.35	93.18	17.79	16.09	7.83	10.96	20.28	53.00	12.00	28.64	8.10	100.90	355.54
43	Alfred L. Hall.....	44.73	12.22	16.55	93.30	19.72	4.23	15.00	37.33	54.00	9.56	33.64	10.24	111.24	329.93
44	Bernard F. Grabo.....	31.53	10.09	8.00	13.60	11.31	5.74	11.44	15.25	26.00	18.90	46.36	8.57	118.56	314.42
45	Gio Kuniyoshi.....	63.59	14.74	7.61	14.70	12.67	4.11	6.62	12.91	92.00	30.44	20.00	20.00	100.43	308.98
46	Henry A. Johnson.....	40.33	8.00	4.26	12.70	11.78	7.59	6.47	15.35	26.00	30.44	20.91	15.95	102.36	269.01
47	Koroku Kato.....	23.09	9.29	9.09	12.91	11.11	4.11	11.05	13.60	32.00	14.44	.....	.....	.....	.....

CADET-MIDSHIPMEN.

Merit-roll of third class (60 members), annual examination, June

Order of annual merit.	Name.	Seamanship.	Ordnance instructions.	Mathematics.	Chemistry.	Rhetoric.	Physical geography.	French.	Drawing.	Conduct.	Aggregat.
1	Maxima	75	18	162	13	12	33	60	18	55	538
2	William F. Fullam	75.00	18.00	157.34	13.97	41.52	33.00	56.25	15.18	52.25	522.73
3	Albert G. Winterhalter	73.92	11.07	160.14	13.00	41.52	32.97	40.00	8.24	52.42	511.98
4	Horace M. Witzel	73.30	45.19	162.00	41.18	39.10	32.62	40.00	8.24	43.15	599.30
5	Alfred Jeffries	72.04	31.54	143.38	36.72	39.78	31.86	54.58	14.17	52.29	577.80
6	John M. Orchard	71.81	46.94	152.60	41.64	34.52	26.93	54.22	17.76	44.09	576.10
7	William V. Brumagh	69.95	46.88	157.31	36.41	36.15	22.00	41.41	17.76	48.29	576.10
8	William G. David	69.95	41.26	145.21	35.50	40.35	25.79	51.19	14.12	47.74	574.24
9	Thomas G. Dodge	71.15	11.64	150.81	35.50	32.31	32.24	41.51	14.12	47.74	574.24
10	Henry C. Jones	61.62	13.71	114.52	42.41	49.07	29.30	56.25	12.67	51.51	534.14
11	Augustus C. Marston	61.66	37.61	118.97	39.31	50.75	29.40	51.86	17.18	41.42	530.67
12	Augustus E. Peck	71.41	31.16	154.75	27.07	36.41	12.72	55.25	17.29	41.41	529.15
13	Frank S. Buckley	48.74	42.14	145.00	40.80	37.06	31.29	49.25	6.71	59.82	516.08
14	Reed Taylor	35.17	35.91	147.15	50.80	39.30	35.04	45.80	14.06	48.52	522.27
15	Richard C. Paris	71.74	12.95	111.52	42.56	32.21	12.52	29.30	41.71	48.08	518.51
16	Henry C. Walker	62.54	34.86	146.74	35.24	30.41	21.45	45.25	17.29	54.74	517.15
17	Frank M. Bosworth	41.31	45.14	145.21	42.41	35.45	22.88	44.11	17.18	47.15	511.17
18	Charles S. Williams	61.84	21.42	135.00	41.15	50.07	54.45	12.75	12.00	43.51	511.26
19	George F. Ormsby	61.82	16.56	145.79	41.04	48.38	25.55	45.47	11.73	45.08	510.84
20	John N. Jordan	72.00	32.84	142.62	24.74	25.79	25.79	45.47	11.73	41.64	510.73
21	Edward E. Wright	42.35	35.94	142.70	51.14	44.46	25.79	45.47	14.12	48.80	510.73
22	Thomas M. Brumby	46.14	29.02	108.21	37.25	35.48	46.25	40.00	12.00	44.00	504.04
23	Nicholas J. L. T. Halpin	58.93	22.18	21.00	29.41	25.16	29.29	57.00	8.91	44.70	505.68
24	Alfred G. Hayes	60.05	11.82	111.52	41.04	50.29	28.43	29.29	14.12	45.08	504.74
25	Water M. Constand	58.05	46.64	114.52	26.04	41.21	17.11	35.25	17.11	50.00	504.14
26	William W. Grant	61.62	35.93	124.56	51.07	22.45	25.79	45.47	17.29	49.00	504.72
27	Albert W. Dodd	62.03	28.00	129.00	41.00	21.72	25.79	45.47	17.29	49.00	504.72
28	Albert N. Wood	45.13	31.90	142.21	40.00	25.25	25.79	45.47	17.29	49.00	504.72
29	James H. Oyster	61.66	22.41	128.48	48.75	35.45	14.15	41.19	41.15	43.15	503.63
30	James P. Parker	61.83	30.86	140.75	44.00	41.75	14.15	41.19	41.15	43.15	503.63
31	Benjamin W. Hodges	70.95	26.00	135.75	36.41	37.75	17.75	46.75	17.75	43.15	503.00
32	Vernon S. Nelson	42.35	37.01	142.41	32.45	41.70	19.75	42.75	17.29	48.80	502.92
33	Jonathan K. Brier	61.13	38.14	140.31	34.00	42.41	24.40	46.75	17.29	48.80	502.92
34	Sam E. Woodworth	61.18	22.74	147.07	52.75	51.15	24.45	45.75	17.29	48.80	502.92
35	David W. Jones	61.75	51.00	144.00	32.75	42.75	25.75	45.75	17.29	48.80	502.92
36	Lewis C. Fletcher	78.17	7.75	152.62	35.75	44.45	17.84	41.75	17.29	48.80	502.92
37	George W. Denfield	61.74	50.00	144.00	34.75	40.75	18.27	45.75	17.29	48.80	502.92
38	Harry M. Donahue	61.75	47.14	140.80	25.75	48.10	18.88	44.75	17.29	48.80	502.92
39	Harry B. Case	68.24	36.00	141.00	29.00	40.00	18.75	44.00	17.29	48.80	502.92
40	Henry H. Rogers	61.15	26.00	144.75	24.00	42.75	14.00	40.00	17.29	48.80	502.92
41	John C. Wilson Jr	61.75	18.25	140.00	28.74	40.41	12.62	40.00	17.29	48.80	502.92
42	Robert O. Dunn	41.16	20.45	141.24	37.51	41.14	29.29	22.37	17.29	48.80	502.92
43	Frank R. Heath	69.24	25.54	128.00	24.45	21.25	14.41	38.75	17.29	48.80	502.92
44	William F. Endress	70.26	26.77	140.00	41.00	28.45	14.72	26.41	17.29	48.80	502.92
45	Frank W. Toppatt	41.78	14.00	78.25	24.00	20.14	14.00	38.75	17.29	48.80	502.92
46	Augustus C. Almy	40.80	44.87	140.75	48.00	41.15	14.00	41.24	17.29	48.80	502.92
47	William B. Osterhant	41.20	18.80	140.00	44.00	28.00	14.75	38.75	17.29	48.80	502.92
48	William S. Benson	58.14	28.00	144.24	18.74	41.52	14.12	41.75	17.29	48.80	502.92
49	William R. Bush	58.80	16.00	76.74	29.41	40.00	14.12	28.45	14.12	41.75	502.92
50	Horace W. Harrison	28.75	47.00	144.24	54.00	40.00	14.12	41.75	17.29	48.80	502.92
51	John H. McNasser	62.12	26.04	75.75	14.00	44.00	14.00	38.75	17.29	48.80	502.92
52	William L. Bardick	61.75	22.00	74.75	20.41	41.24	14.12	29.75	17.29	48.80	502.92
53	Philip V. H. Lonsdale	60.93	21.04	81.75	24.41	22.25	14.00	38.75	17.29	48.80	502.92
54	Frederick L. Werlich	56.80	22.75	74.75	25.00	40.00	14.00	38.75	17.29	48.80	502.92
55	Simon Cook	61.75	24.78	81.75	16.00	40.00	14.12	28.45	14.12	41.75	502.92
56	George D. Donnelly	61.00	14.44	75.75	24.75	40.00	14.00	38.75	17.29	48.80	502.92
57	James D. Shocks	24.00	26.00	74.75	14.00	44.00	14.00	38.75	17.29	48.80	502.92
58	Lyman B. Messinger	45.75	22.00	84.75	14.00	40.00	14.00	38.75	17.29	48.80	502.92
59	Thomas B. Maynauer	59.76	22.12	86.75	14.15	41.75	14.00	38.75	17.29	48.80	502.92
60	Frederick Hodges	61.75	14.88	75.75	14.00	41.75	14.00	38.75	17.29	48.80	502.92
61	Oleiver J. Schmeckert	24.85	25.50	76.44	14.00	45.75	14.00	38.75	17.29	48.80	502.92

CADET-MIDSHIPMEN.

Merit-roll of fourth class (94 members), annual examination, June, 1875.

Order of annual merit.	Name.	Mathematics.	English.	History.	French.	Conduct.	
		120	30	42	24	15	
*1	John H. Fillmore.....	120.00	29.64	40.38	19.23	13.79	22
*2	Charles N. Atwater.....	116.92	28.93	41.46	21.05	14.04	22
*3	Thomas S. Rodgers.....	112.31	28.57	39.85	23.72	13.89	21
*4	Harry S. Knapp.....	115.38	30.00	38.77	20.35	12.54	21
*5	James H. Glennon.....	118.40	27.14	33.92	23.16	12.95	21
6	John G. Quinby.....	113.85	26.07	37.69	18.95	12.27	20
7	Thomas W. Ryan.....	110.77	22.50	36.62	21.61	11.42	20
8	J. H. L. Holcombe.....	106.15	28.04	35.00	17.40	14.21	20
9	William C. Canfield.....	103.08	24.64	37.15	22.04	13.79	20
10	Richard M. Hughes.....	98.46	27.14	40.92	19.79	13.54	19
11	Robert K. Wright.....	109.23	23.57	31.80	21.61	10.97	19
12	Edward Lloyd, Jr.....	100.77	25.71	32.85	22.88	14.29	19
13	Payton B. Bibb.....	104.62	24.11	25.85	21.05	13.22	18
14	Chester A. Mayer.....	89.23	29.29	42.00	15.16	10.71	18
15	Spencer F. B. Biddle.....	107.69	21.79	28.54	14.60	13.53	18
16	Frank J. Sprague.....	96.92	28.04	33.38	14.00	11.10	18
17	George K. Clark.....	95.38	23.21	35.54	15.72	12.09	18
18	Frank C. Skinner.....	81.54	26.43	39.31	18.39	14.20	17
19	Roy C. Smith.....	93.85	25.36	21.54	22.32	14.18	17
20	George H. Hess.....	100.77	16.79	26.92	16.70	12.80	17
21	Charles S. McClain.....	83.85	27.14	29.08	17.96	14.27	17
22	Asa D. Carrington.....	89.23	19.29	30.42	20.07	12.62	17
23	Fernando L. Young.....	86.15	22.50	27.73	16.98	14.27	16
24	Arthur B. Tracy.....	69.23	25.00	32.31	20.63	14.03	16
25	Harry M. L. P. Huse.....	63.08	24.11	34.46	24.00	13.50	15
26	John L. Purcell.....	79.23	14.82	31.50	16.28	12.90	15
27	George H. Stafford.....	89.23	20.29	38.21	8.84	14.13	15
28	James H. Hetherington.....	89.23	14.82	35.85	8.80	12.78	15
29	William P. White.....	92.31	10.36	22.08	13.05	12.24	14
30	George Sparhawk.....	58.46	22.50	36.08	17.40	12.24	14
31	John J. Knapp.....	83.85	18.39	18.31	11.79	13.68	14
32	William E. W. Hall.....	76.92	18.39	16.69	18.67	12.24	14
33	Horatio H. Hooke.....	79.23	13.57	25.85	11.79	11.96	14
34	William L. Todd.....	75.38	12.68	22.62	15.16	11.61	14
35	Harry Kimmell.....	72.31	16.79	17.23	16.28	12.58	13
36	Robert P. Fannleroy.....	60.77	20.18	23.15	17.96	12.62	13
37	John H. Shipley.....	55.38	19.64	29.62	12.35	14.69	13
38	Thomas Dickinson.....	56.92	20.69	20.73	19.31	11.28	12
39	John E. Craven.....	73.85	11.43	11.85	15.72	13.08	12
40	Baine C. Dent.....	64.62	16.79	17.77	12.35	11.31	12
41	Charles W. Garrett.....	50.10	21.43	24.21	9.54	12.68	11
42	John Greene Mason.....	66.15	11.96	15.35	7.72	12.89	11
43	Homer C. Poundstone.....	50.00	16.79	10.12	13.05	14.43	11
44	John E. McDonnell.....	53.85	15.36	14.27	8.56	14.34	10
45	Lovell H. Webb.....	45.38	16.79	16.15	14.18	12.41	10
46	James B. Cahoon.....	40.77	15.71	24.23	11.37	12.60	10
47	Allen G. Rogers.....	47.69	17.86	14.27	16.95	11.85	10
48	Andrew S. Rowan.....	40.77	12.68	24.23	10.53	12.78	10
49	Prentice Bailey.....	45.38	11.96	11.31	13.05	12.81	9
50	William Crosby.....	43.08	10.71	13.46	10.25	12.90	9
	John Gibson.....	69.23	10.00	10.77	9.54	14.16	11
	Louis H. Barnard.....	33.08	20.18	30.42	13.89	14.30	11
	Harry L. Sturdevant.....	60.77	7.50	15.35	5.16	10.65	10
	John A. Bell.....	54.31	8.21	19.12	6.28	10.89	9
	Daniel P. Menefee.....	29.23	18.93	20.73	13.61	13.28	9
	Joseph Beale.....	30.77	13.57	27.73	10.95	11.75	8
	Perceval L. Drayton.....	23.08	11.67	19.92	22.60	11.63	8
	Oliver H. P. Belmont.....	25.38	13.57	10.23	23.44	10.93	8
	Frank H. Swift.....	33.08	14.29	9.15	9.54	13.56	7
	John A. Dougherty.....	35.38	9.64	8.62	8.28	13.95	7
	Samuel Richardson.....	36.92	8.57	12.38	6.40	11.54	7
	Edwin H. Tillman.....	38.46	7.86	8.08	8.46	13.60	7
	William J. Maxwell.....	25.38	8.93	12.92	9.54	12.56	6
	Bushrod W. Taylor.....	27.69	9.29	9.69	7.44	12.49	6
	Kantaro Arima.....	(a)	(a)	(a)	(a)	(a)	5
	William L. Rodgers.....	56.15	23.75	34.19	14.28	12.93	11

|| Absent, (sick,) during annual examination, examined in September.

CADET-MIDSHIPMEN.

Fourth class (94 members), deficient sections.

The following Cadets, having been turned back at the semi-annual examination, have no relative position with the members of the fourth class.

† Henry E. Baker, jr.	‡ William A. Graham.	‡ Alfred N. Paxton.
‡ David L. Bartlett.	‡ Alfred G. Gray.	‡ William W. Picking.
‡ Howard C. Boon.	‡ James Gray.	‡ George H. R. Preble.
‡ John P. Boyd.	‡ Arthur B. Guinnip.	‡ Maurice L. Read.
‡ Charles R. Breck.	‡ Charles W. Jungen.	‡ Joseph L. Redfern.
‡ Ambrose Cramer.	‡ Robert F. Lopez.	‡ Rennie P. Schwerin.
‡ LeRoy E. Cummings.	‡ Alfred I. Maury.	‡ Edwin B. Webster.
‡ Andrew C. Cunningham.	‡ Frederick P. Meares.	‡ George S. Welsh.
‡ Edward D. Fitzgerald.	‡ Alfred G. Morey.	‡ Llewellyn V. Wilson.

CADET-ENGINEERS.

Merit-roll of the first class (16 members), annual examination, June, 1875, and general merit-roll for two years.

Order of general merit.	Name.	Steam.	Electricity.	Chemistry.	Heat.	Applied mathematics.	French.	Conduct.	Aggregate for second year.	Aggregate for first year.	Aggregate for two years.
	Maxima.....	198	45	99	45	120	45	150	702	355	1057
1	Frank H. Bailey.....	198.00	49.71	89.57	43.00	120.00	15.00	150.00	656.27	310.47	966.75
2	William Cowles.....	189.20	42.86	80.14	33.00	112.00	22.00	144.20	627.40	298.35	925.75
3	George S. Willits.....	180.40	33.21	70.71	29.00	112.00	37.60	149.85	612.17	298.97	911.14
4	William L. Cathcart.....	171.60	36.43	84.86	37.00	82.00	39.00	146.85	603.74	285.21	888.95
5	Walter F. Worthington.....	132.00	23.57	99.00	31.00	72.00	43.00	149.85	550.42	250.68	801.10
6	William N. Little, jr.....	154.00	38.57	61.20	25.00	66.67	25.00	139.35	509.88	276.15	786.03
7	Edgar T. Warburton.....	132.00	30.00	94.20	45.00	98.67	30.00	149.55	579.51	186.42	765.93
8	Theodore F. Burgdorff.....	118.80	45.00	42.43	39.00	82.67	35.00	142.80	505.70	241.42	747.12
9	William R. King.....	74.80	20.36	28.20	27.00	104.00	22.00	134.00	414.45	313.95	728.40
10	Edward R. Freeman.....	101.20	25.71	47.14	35.00	56.00	33.00	143.10	441.15	261.80	702.95
11	George H. T. Babbitt.....	110.00	27.86	54.21	21.00	93.33	30.00	137.10	473.50	179.38	652.88
12	Frank H. Eldridge.....	162.80	33.21	54.21	23.00	50.67	17.00	149.55	490.44	162.28	652.72
13	Charles Kleckner.....	83.60	17.14	66.00	41.00	61.33	19.00	141.30	429.37	211.02	640.39
14	Alberto De Ruiz.....	66.00	15.00	33.00	15.00	42.67	45.00	131.10	347.77	254.78	602.55
15	Edmund C. Loomis.....	92.40	20.36	37.71	17.00	77.33	27.00	143.70	415.50	185.21	600.71
16	William B. Boggs.....	145.20	12.86	75.43	19.00	42.67	41.00	141.75	477.91	245.95	723.86

CADET-ENGINEERS.

Merit-roll of the second class (3 members), annual examination, June, 1875.

Order of annual merit.	Name.	Mathematics.	Steam.	French.	Conduct.	Aggregate.
	Maxima.....	150	99	51	55	355
1	William B. Dunning.....	150.00	99.00	34.00	52.47	335.47
2	Robert I. Reid.....	100.00	66.00	51.00	51.43	268.43
3	Henry H. Stivers.....	50.00	33.00	17.00	53.30	153.30

CADET-ENGINEERS.

Merit-roll of the fourth class (26 members), annual examination, June, 1875.

Order of annual merit.	Name.	Mathematics.	Grammar.	History and composition.	French.	Conduct.	Aggregate.
	Maxima.....	120	30	42	24	15	231
*1	Ira N. Hollis.....	120.00	30.00	42.00	24.00	14.49	230.49
*2	Franklin J. Schell.....	115.79	26.82	36.40	18.11	14.91	212.03
*3	Goold H. Ball.....	111.58	22.73	33.60	20.63	13.28	201.82
*4	Frank W. Bartlett.....	98.95	26.82	35.00	22.32	13.31	196.40
*5	Harry W. Spangler.....	107.37	28.18	28.00	15.58	14.16	193.29
6	Howard Gage.....	94.74	25.00	40.60	16.42	14.39	191.15
7	George W. McElroy.....	103.16	21.82	30.80	13.89	12.96	182.63
8	Joseph R. Wilmer.....	65.26	29.09	32.20	23.16	14.45	164.16
9	Robert S. Griffin.....	90.53	20.00	18.20	19.79	14.36	162.88
10	Charles L. Wight.....	69.47	20.91	37.80	18.95	14.82	162.01
11	Frederick C. Bieg.....	73.68	18.18	29.40	21.47	14.54	155.37
12	Mortimer E. Cooley.....	86.32	19.09	19.60	17.26	14.03	156.30
13	John L. Gow.....	*82.11	25.00	21.00	8.84	13.98	150.93
14	Henry K. Ivers.....	56.84	23.64	39.20	11.37	14.87	145.87
15	Joseph McC. Pickrell.....	77.89	13.64	24.50	14.74	13.43	144.20
16	Horace G. Dungan.....	52.63	11.36	15.40	13.05	14.43	106.87
17	George E. Burd.....	40.00	17.27	14.00	8.00	14.16	93.43
†	Frank M. Bennett.....	46.32	15.91	26.60	4.63	13.49	106.95
†	Thomas J. Hogan.....	35.79	15.91	22.40	10.53	14.22	98.85
†	George R. Salisbury.....	61.05	8.18	8.40	2.95	14.85	95.43
†	Edward H. Scribner.....	46.32	9.09	9.80	12.21	14.24	92.66
†	Harold P. Norton.....	31.58	10.00	24.50	5.47	14.96	86.51
†	Harry S. Elseffer.....	23.16	11.36	16.80	7.16	12.99	71.47
†	Henry F. Harrison.....	14.74	12.73	12.60	9.62	14.40	64.15
†	John U. Crygier.....	18.95	14.55	11.20	6.32	13.05	61.07
†	Henry O'Connor.....	27.37	7.27	7.00	3.79	13.97	59.40

† Allowed to enter the next fourth class on condition of passing at the competitive examination in September.

REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

I. The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; and ten appointed annually at large.

II. The nomination of candidates for admission from the District of Columbia and at large is made by the President. The nomination of a candidate from any congressional district or Territory is made on the recommendation of the Member or Delegate from actual residents of his district or Territory.

III. Each year, as soon after the 5th of March as possible, Members and Delegates will be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress.

IV. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 21st of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the examination, will be examined on the 12th of September following; and should any candidate fail to report, or be found physically or mentally disqualified for admission on June 21, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined on the 12th of September following. When any of the dates assigned for examinations fall on Sunday, the examination will take place on the following Monday.

V. A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting nominations and attempting to enter a service for which they are not fitted.

EXAMINATION.

I. Each candidate for appointment as Cadet-Midshipman must present to the Academic Board satisfactory testimonials of good moral character, and must certify on oath to his precise age, which must be over fourteen and less than eighteen years, at the time of the examination. No candidate will be examined whose age does not fall within the prescribed limits.

II. Candidates must be physically sound, well formed, and of robust constitution; and will be required to pass a satisfactory examination before a medical board com-

posed of the surgeon of the Naval Academy, and two other medical officers to be designated by the Secretary of the Navy.

VIII. Any one of the following conditions will be sufficient to cause the rejection of a candidate:—

Feeble constitution, inherited or acquired;

Greatly-retarded development;

Permanently-impaired general health;

Decided cachexia, diathesis, or predisposition;

All chronic diseases or results of injuries that would permanently impair efficiency, viz:—

Weak or disordered intellect;

Contaneous and communicable diseases;

Unnatural curvature of spine, torticollis, or other deformity;

Permanent inefficiency of either of the extremities or articulations from any cause;

Epilepsy or other convulsions within five years;

Impaired vision, or chronic disease of the organs of vision;

Great hardness of hearing, or chronic disease of the ears;

Chronic nasal catarrh, ozena, polypi, or great enlargement of the tonsils;

Impediment of speech to such an extent as to impair efficiency in the performance of duty;

Decided indications of liability to pulmonary disease;

Chronic cardiac affections;

Hernia or retention of testes in inguinal cavity;

Sarcocoele, hydrocele, stricture, fistula, or hæmorrhoids;

Large varicose veins of lower limbs, scrotum, or cord;

Chronic ulcers.

Attention will also be paid to the stature of the candidate; and no one manifestly under size for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates who fall below the standard will receive a second and final examination in the subjects in which they fail. Deficiency in any one of the subjects at the second examination will be sufficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have the privilege of another examination for admission to the same class unless recommended by the Board of Examiners."—[*Rev. Stat.*, § 1515.]

GENERAL CHARACTER OF QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is required to express in figures any whole number, decimal, or mixed number; to write in words any given number; and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of addition and

decimal fractions, and is expected to be able to give clearly the reasons for such processes, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school-arithmetics. It is essential that the candidate shall be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance, (attention is specially called to the rivers and bodies of water on which cities are situated); the course of a vessel in making a voyage between well-known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as treated in the common-school text-books, embracing the following subjects: The divisions of letters, and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in

ADDENDA TO ARTICLE XII.

Percentage, Interest, and Discount.—Examples usually given under these heads in arithmetics.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflexion of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense-endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs*; conjunctive adverbs; the use of *prepositions*, *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under *syntax*.

Parsing, according to the following model :

Noun : Class, gender, number, person, case.

Article : Definite or indefinite ; qualified noun.

Adjective : Class ; compared or not compared ; comparison, if admitting it ; of comparison ; qualified noun.

Personal pronoun : Person, gender, number, case.

Relative pronoun : Person, gender, number, case, antecedent.

Interrogative pronoun : Gender, number, case.

Adjective pronoun (or pronominal adjective) : Class ; qualified word.

Verb : Class, form, principal parts, tense, mood, voice, person, number, subject.

Adverb : Class ; derivation and comparison, if derived and compared ; qualified.

Preposition : Words between which the relation is shown by the preposition.

Interjection : The kind of emotion expressed.

Conjunction : Class ; words or sentences connected.

The construction of the word will be required in all cases.

READING.—Candidates will be examined in reading aloud English prose, in a hard work ; for example, Bancroft's History of the United States.

WRITING AND SPELLING.—Candidates will be required to write a short original and an exercise in dictation, and to spell twenty-four words in common use.

An exercise containing eight or more mistakes in spelling will not be considered satisfactory, and will be sufficient of itself to cause the rejection of the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations will receive pointments as Cadet-Midshipmen, and become inmates of the Academy. Each will be required to sign articles by which he binds himself to serve in the United Navy eight years (including his time of probation at the Naval Academy), unless discharged. The pay of a Cadet-Midshipman is \$500 a year, commencing at the time of his admission.

XIV. Cadets immediately after their admission will supply themselves with the following articles, viz :

One parade-suit	\$37 72	One hair-mattress
One undress-suit	15 79	One straw-mattress
One working-suit	3 63	One hair-pillow
One overcoat	22 80	One pair blankets
One rubber-coat	5 52	Two bed-spreads
One parade-cap	3 95	Six sheets
One undress-cap	1 75	Four pillow-cases
* Two pairs high shoes	12 50	* One tooth-brush
One pair gymnastic slippers	1 22	* One hair-brush
* Eight white shirts	16 00	* One whisk
* Two night-shirts	3 00	* One coarse comb
* Four under-shirts	2 52	* One fine comb
Twelve linen collars	1 80	One mug
* Eight pairs socks	2 00	* One cake soap
* Four pairs drawers	3 00	One soap-dish
* Six handkerchiefs	2 04	One requisition-book
* Eight towels	2 00	One laundry-book
Two pairs drill-gloves	1 32	One pass-book
Two pairs Lisle-thread gloves	72	One stencil and ink
* One pair suspenders	46	* One thread and needle case
One silk handkerchief	77	One rug
One neck-tie	84	One wash-basin
Two clothes-bags	70	

Room-mates will procure for their common use—

One looking-glass (half-cost).....	\$0 75	One broom (half-cost)	\$0 20
One water-pail (half-cost)	53	One table-cover (half-cost).....	75
One slop-bucket (half-cost).....	66		
Total			179 99

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home, but all other articles must conform to the regulations, and must therefore be supplied by the store-keeper.

X. Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of \$50, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, in the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of fifty dollars must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing	\$179 99
Deposit for books, &c.....	50 00
Total deposit required	229 99

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XV. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling-expenses.

GEO. M. ROBESON,
Secretary of the Navy

EXAMINATION OF CANDIDATES FOR ADMISSION AS CADET-MIDSHIPMEN
JUNE, 1875.

ARITHMETIC.

JUNE 23, 1875.—Time allowed, four hours.

1. Divide 573.24 by 2,000,000; divide .01 by 100; divide 100 by 0.0001; divide 1.0665 by 0.00135. Reduce $\frac{11}{160000}$ to a decimal. Find what decimal part 0.00135 is of 1.0665.
2. Simplify $\frac{1.18}{.152} \times \frac{3.64}{2.95}$. Add $\frac{2}{3}$ of $\frac{3}{4}$ to $\frac{3}{4}$ of $2\frac{1}{2}$, and multiply the result by $\frac{\frac{2}{3} \text{ of } \frac{3}{4}}{\frac{3}{4} + \frac{2}{3}}$.
- Multiply together $\frac{2}{3}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{12}$, $\frac{1}{12}$, $\frac{1}{12}$, $\frac{1}{12}$, $\frac{1}{12}$, and $\frac{1}{12}$.
3. Divide $(2 + \frac{1}{2} + \frac{1}{3} + \frac{1}{12} + \frac{1}{15} + \frac{1}{18})$ by $(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5})$. Divide the greatest of the fractions $\frac{1}{2}$, $\frac{1}{4}$ of $2\frac{1}{2}$, $\frac{1}{4}$ of $3\frac{1}{2}$, and $\frac{1}{2}$ of $4\frac{1}{2}$ by the least.
4. What weight is the same fraction of 5 lbs. 8 oz. 4 dwts. 22 grs. that £1 11s. 10d. is of £3 10s. 1½d.? A train travels at the rate of 30 miles an hour; over what distance in feet does it pass in one second?
5. Separate each of the numbers 1156155, 121121, and 13377 into its prime factors. State in general terms which factors must be taken to form the least common multiple, and which to form the greatest common divisor. Find the least common multiple and greatest common divisor of the above three numbers, using the factors already found.
6. Find to five decimal places the sum of the fractions—
- $$\frac{1}{1'} + \frac{1}{1'} + \frac{1}{2'} + \frac{1}{2.3'} + \frac{1}{2.3.4'} + \frac{1}{2.3.4.5'} + \frac{1}{2.3.4.5.6'} + \frac{1}{2.3.4.5.6.7'} + \frac{1}{2.3.4.5.6.7.8'}$$
- and
- $$\frac{1}{2.3.4.5.6.7.8.9'}$$

Solve two of the following questions.

7. A can perform a piece of work in $2\frac{1}{2}$ days, and B can do the same work in 3 days; how long would it take them to do it working together? and if \$7 is paid for the whole work, how should it be divided between them?
8. A man who rows 4 miles in an hour in still water takes an hour and twelve minutes to row that distance up a river; how long does it take him to row down again?
9. A train approaching a station sounds a whistle on passing each of two posts which are placed half a mile apart. The interval between the times at which the sounds are heard at the station is 42.4 seconds. Supposing that sound travels 1100 feet per second, at what rate in miles per hour is the train traveling?
10. A can run a mile in 7.68 minutes and B can run 7.68 miles per hour; which is the faster runner, and, in a race which the faster wins in six minutes, how far will the loser be behind?

ENGLISH BRANCHES.

JUNE 23, 1875.—Time allowed, three hours.

GRAMMAR.

1. Define *comparison, syntax, auxiliary verb, adverb*.
2. Give the possessive plural of *basis, sea, beef, fisherman, talisman*.
3. Inflect (or decline) *thief, mercy, princess, pincers*.

4. What is the difference in meaning between the auxiliaries *may* and *must*?
5. Compare *nigh*, *happy*, *fit*, *old*.
6. Give the principal parts of *cost*, *lead*, *read*, *sweep*, *lay*.
7. Parse the words in italics:

Hear my decree;
This day have I *begot whom* I declare
My only son; your *head* I him appoint.

8. Correct the following sentences:

You and me are going on board ship, ain't we?
 It rains most every day.

SPELLING.

Generous.	Instigate.	Academy.	Irksome.
Ingenu.	Derisive.	Mariner.	Extension.
Essential.	Discipline.	Strategy.	Obsolete.
Symptom.	Agreeable.	Contagious.	Usually.
Inveigle.	Illuminate.	Courageous.	Familiar.
Elly.	Eliminate.	Congeat.	Coalesce.

GEOGRAPHY.

1. Bound Bolivia.
2. Where is Gibraltar? Callao? Pernambuco? Singapore? Glasgow?
3. Give the source, direction, and mouth of the Red River; Yellowstone River; Colorado River; Orange River.
4. Where is Mt. Hecla? Vesuvius? Cotopaxi? Etna?
5. Make a coasting-voyage from St. Petersburg to Barcelona, touching at three seaports of France. Name in order the countries you pass and the waters you sail through.
6. What bodies of land are separated by Torres Strait? Strait of Mackinaw? Strait of Sunda? Strait of Juan de Fuca?

RE-EXAMINATIONS.

ARITHMETIC.

JUNE 24, 1875.—Time allowed, four hours.

1. Add together 1.465, .0095, 37.15, 28.456, and 16.1685, and divide the sum by .0296. Divide 625 ten-millionths by 125 thousandths. What decimal part of 24 hours is 8 hours 15 minutes 19.2 seconds?

2. From $12\frac{3}{4}$ take the sum of $\frac{3}{8}$ of $3\frac{1}{2}$ and $\frac{5}{8}$ of $13\frac{1}{2}$, and divide the result by $2\frac{1}{4}$.

What number multiplied by $2\frac{3}{4}$ will give 2 for the product? (Express the fractional part of the result decimally.)

3. Change $\frac{2}{3}$ of $1\frac{1}{3}$ to an equivalent fraction having 81 for its denominator. What number is that from which, if 9 be subtracted, $\frac{1}{4}$ of the remainder is 16?

4. Find the prime factors of 111540, 42336, and 67392, and thence write down the true factors of the least number which will contain each of the three given numbers without a remainder.

How may the least common multiple of two given numbers be found when their greatest common divisor is also given?

5. Simplify .12 of (.0104 - .002) + .36 of .002, and express the result as a fraction.

6. Reduce the fraction $\frac{\text{£}20 \text{ } 3\text{s. } 9\text{d.}}{\text{£}60 \text{ } 11\text{s. } 3\text{d.}}$ of $\frac{1 \text{ mile } 880 \text{ yards}}{3 \text{ miles}}$ to its simplest form, and state the denomination of the result.

6. Find to five decimal places the value of the expression—

$$1 - \frac{1}{2} + \frac{1}{2.3.4} - \frac{1}{2.3.4.5.6} + \frac{1}{2.3.4.5.6.7.8} - \frac{1}{2.3.4.5.6.7.8.9.10}$$

Solve two of the following questions.

7. A room is 38 feet 8 inches long, 13 feet 6 inches wide, and 10 feet 9 inches high. Find the cost of papering the walls with paper 1 foot 10 inches wide at 12 cents linear yard, and of carpeting the floor with carpet $\frac{1}{2}$ yard wide at \$1.25 per yard.

8. In a boat-race, the *A* crew rowed 39 strokes per minute and the *B* crew 41; but strokes of the former were equivalent to 20 of the latter. The *A* crew rowed over course of 4 miles in 25 minutes. Find the number of feet and the number of seconds by which the race was won.

9. A person started at half past two, and walked to a village, arriving there when the church-clock indicated a quarter past three; after staying 25 minutes, he drove back by a road one-fourth as long again, at a rate twice as fast as he had walked, and reached home at 4 o'clock. Determine how much the village-clock was wrong.

10. Two clocks were set right at half past seven in the evening of June 1, 1875; but it is found that one gains 7 seconds in 11 hours and the other loses 11 seconds in 10 hours. If their rates continue unaltered, when will they be together again?

ENGLISH BRANCHES.

JUNE 24, 1875.—Time allowed, three hours.

GRAMMAR.

1. What adverb corresponds to the adjective *good*? *pretty*? *true*? *wise*? *noble*?
2. Give the principal parts of *smite*, *rid*, *steal*, *throw*.
3. What part of speech is *as* in each of the following sentences?
Do as I do.
As we have finished, we will go.
Let such as hear, take heed.
4. Give the superlative of *shy*; of *happy*; of *unsuitable*. Give the positive of *less*, *next*.
5. Decline (or inflect) *dwarf*, *leaf*, *city*, *journey*, *which*.
6. "*Whom the gods love die young*" was said of yore. Parse the words in italics.
7. Correct: He does like we do.
That child looks beautifully.

SPELLING.

Vacillate.	Courtesy.	Artillery.	Britain.
Ruffian.	Citizen.	Dissipated.	Collision.
Embarrass.	Jealousy.	Linen.	Separate.
Harass.	Chemistry.	Acquittal.	Maritime.
Polygamy.	Financial.	Icicle.	Infancy.
Literary.	Conscience.	Local.	Speech.

GEOGRAPHY.

1. Name the States of the United States which have no sea-coast, and give the capital of each of them.
2. Locate Cairo (United States), Mazatlan, Bremen, Trieste, Brest.
3. Describe the following rivers: Danube, Cumberland, Tagus, Lena.
4. Give the position of the following, and state to what country each belongs: Mal Cape Verde Islands, Ceylon, Cyprus.
5. Where are Capes Fear, Mendocino, Blanco, Clear, Guardafui?
6. Give the position of the following mountains: Alleghany, Jura, Altai, Mt. St. El

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

I. In pursuance of law, applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. The number of appointments which can be made is limited by law to twenty-five each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 5th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four academic years, with two additional years at sea. All cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer is the same as that of a Cadet-Midshipman, \$500 per annum, and at sea the same as Midshipmen.

V. The academic examination previous to appointment will be competitive and will be on the following subjects, namely: Arithmetic; algebra, through equations of the first degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition; and geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those of Cadet-Midshipmen.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1875.

ARITHMETIC.

Time allowed, three hours.

1. Find the *sum, difference, product, and two quotients* of 30.33 and .0337, and find *sum* of all the results. Take $\frac{1}{2}$ of £4 10s. 9d. from $\frac{2}{3}$ of £6 6s. 9d.

2. Reduce 3 qts. 1 pt. $2\frac{1}{2}$ gills to the fraction of 5 galls. 2 qts. 1 pt. If $25\frac{1}{2}$ francs equal to £1, what fraction of a shilling is 1 franc?

3. To the continued product of $6\frac{1}{2}$, $7\frac{1}{2}$, and $8\frac{1}{2}$, add $3\frac{3}{4}$, and divide the sum by $10\frac{1}{2}$ of $12\frac{1}{2}$. Reduce the fraction $\frac{3 \text{ lbs. } 3 \text{ oz. } 5 \text{ dwts.}}{8 \text{ lbs. } 5 \text{ oz. } 8 \text{ dwts.}}$ to its simplest form.

4. Find the square root of 278.035 and the cube root of 356.88, each to three decimal places.

5. The interest on £250 for 73 days amounts to £18 15s.; find the rate of interest *annum*. The interest on a certain sum of money for 2 years is \$344.79, and the amount on the same sum for the same time is \$306.48, simple interest being reckoned in both cases; find the rate per cent. *per annum* and the sum.

6. A and B are two railway companies that pay respectively $4\frac{1}{2}$ per cent. and 1 per cent. *per annum* on their \$100 shares. When the price of a share in A is $191\frac{1}{2}$ and in B is $32\frac{1}{4}$, in which company is it most advantageous to invest? and what is the difference of income that would arise from an investment of \$17415. in one rather than the other?

ALGEBRA.

Time allowed, two and a half hours.

1. Simplify the expression—

$$2a - (3b + c - 2d) - \frac{1}{2}(2a - 3b) + (c - 2d) + \frac{1}{3}2a - (3b + c) - 2d - \frac{1}{4}(2a - 3b + c) - 2d$$

Multiply $x^{\frac{1}{2}} + x^{-\frac{1}{2}}$ by $x^{\frac{1}{2}} - 1 + x^{-\frac{1}{2}}$.

Divide $a^{\frac{n+1}{2}} + b(ab^{\frac{1-n}{2}} + a^n) + b^{\frac{n+1}{2}}$ by $a + b$.

2. Simplify the expression—

$$3a - [b + \{2a - (b - a)\}] + \frac{1}{2} + \frac{2c^2 - \frac{1}{2}}{2c + 1}$$

Find the value of $\frac{x-a}{b} - \frac{x-b}{a}$ when $x = \frac{a^2}{a-b}$.

Separate $4a^2b^2 - (a^2 + b^2 - c^2)^2$ into four factors.

3. Simplify $\frac{m^2 - n^2}{m^2 + n^2}$ of $\frac{\frac{m^2 + n^2}{n} - m}{\frac{1}{n} - \frac{1}{m}}$.

Find the value of $\frac{x+y-1}{x-y+1}$ when $x = \frac{ab+a}{ab+1}$, $y = \frac{a+1}{ab+1}$.

4. Solve the equations—

$$\frac{3x-1}{5} - \frac{13-x}{2} = \frac{7x}{3} - \frac{11(x+3)}{6}$$

$$\frac{ax^2 + bx + c}{px^2 + qx + r} = \frac{ax + b}{px + q}$$

$$\frac{mx - a - h}{px - c - d} = \frac{mx - a - c}{nx - b - d}$$

5. Two persons, *A* and *B*, can perform a piece of work in *a* days; they work together for *b* days, when, *A* being called off, *B* is left to finish it, which he does in *c* days more. In what time could each do it separately?

GEOMETRY.

Time allowed, two hours.

1. Define *plane surface*, *right angle*, *perpendicular*. Prove that when two straight lines intersect, the opposite or vertical angles are equal, and that the two straight lines which bisect the two pairs of vertical angles are perpendicular to each other. Define *polygon*. Give the names of as many polygons as you can, stating the number of sides of each.

2. Prove that the sum of all the exterior angles of any polygon is four right angles. Define *rhombus*, *rhomboid*, *trapezoid*, *trapezium*. Draw a diagram of each.

3. Prove that the three perpendiculars erected at the middle points of the sides of a triangle meet in a point.

4. Prove that an inscribed angle is measured by one-half its intercepted arc.

5. In a right triangle *ABC*, right-angled at *C*, *D* is the middle point of *BC*, and *E* the middle point of *AC*. *BE* and *AD* are drawn intersecting at *O*. Find the length of *OC*, denoting the side *AC* by *a* and *BC* by *b*.

ENGLISH GRAMMAR.

I. Define (1) *auxiliary*, (2) *impersonal verb*, (3) *comparative degree*, (4) *subjunctive mood*.

II. Give the principal parts [all forms] of (1) *befall*, (2) *drown*, (3) *sink*, (4) *burst*, (5) *lie* [meaning to recline], (6) *set*.

III. What part of speech is *but* in each of the following sentences?

1. You need not go, but I will.

2. I tell you, but one of us can go.

3. None but the brave deserves the fair.

IV. Decline [or inflect] *cannon*, *clothes*, *goose*, *grotto*, *alkali*.

V. Give the possessive, singular and plural, of *grief*, *sheaf*, *talisman*.

VI. Parse the words in italics in the following passage:—

A still, small voice *spoke* unto me:

"Thou art so full of misery,

Were it not better not to be?"

GEOGRAPHY.

1. Fix the position of Milwaukee, Memphis, Liverpool, Belgrade, stating on what body of water each is situated.

2. Where is Mont Blanc? Mt. Hecla? Mt. Sinai? Mt. St. Elias?

3. Make a voyage from Duluth to Albany. Name in order the States you pass on your right hand and the waters you pass through.

4. Where is Herzegovina? Muscat? Jerusalem? Leghorn?

5. Fix the position of the following arms of the sea, telling what country each indents, and of what water it is a branch:

1. Chaleurs Bay. 2. Gulf of Tonquin. 3. Delagoa Bay. 4. Sea of Azov.

SPELLING.

Correspond.	Antithesis.	Countersign.	Fabricate.
Taciturn.	Brevity.	Criterion.	Artifice.
Euphony.	Christen.	Indelible.	Discipline.
Elegant.	Epithet.	Essential.	Solemn.
Barbarous.	Represent.	Symbol.	Impugn.
Florid.	Cancellation.	Perjury.	Placard.

Candidates are required to write a short original letter and an exercise in dictation.
Time allowed in English branches, three hours.

NATURAL PHILOSOPHY.

Time allowed, three hours.

1. Define *centre of gravity*. How could you find the centre of gravity of a board of uniform thickness, cut in the form of a trapezium?

2. Define *specific gravity*. What is taken as the standard for solids and liquids?

EXAMPLE.—(1) A substance weighing 310 grains weighs 188.5 in water; required its sp. gr. (2) Determine sp. gr. of wood from:—weight of wood, 25.35; weight of sinker under water, 9.77; weight of wood with sinker under water, 5.10 grammes.

3. What is the effect of *gravity* upon the *velocity* of a falling body? A body influenced by gravity falls meeting with no resistance; what will be its velocity at the end of one second from rest? Through what *space* will it have fallen at the end of one second?

4. Define *mass of a body*; *momentum*.

5. Give the *three laws of motion*. Illustrate.

6. State upon what principle the *hydrostatic press* is based. Draw a diagram, and explain how a great pressure can be obtained.

7. Explain the principle of the *siphon*. Is there necessarily a limit to the height of the bend from the level of the liquid being drawn off?

8. What is shown by the *barometer*? Why is mercury more generally used in barometers than other liquids?

9. A rod without weight, eighteen inches in length, has weights at each end, of 1 pound and 10 pounds respectively; at what point must the rod be supported in order that the weights may balance?

10. What are the temperatures on the *centigrade scale* corresponding to the following temperatures, Fahrenheit: 100° , 0° , -40° ?

COURSE OF INSTRUCTION FOR CADET-MIDSHIPMEN.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.—Description of all kinds of rope, and its practical manipulation for all purposes on shipboard; measuring for and fitting standing and running rigging; mastng, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seamanship, with lectures, and illustrations from models.

NAVAL ARCHITECTURE AND SHIP-BUILDING.

Text-books.—Thearle's Naval Architecture, and Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.—Organization, formations, and maneuvering of a fleet, under steam or sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.—Exercises on shipboard, with sails and spars.

NAVAL TACTICS.—Exercises in boats, under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal-Code.

Instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.—*Practical naval gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial, remaining, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY-TACTICS.—Organization and formation of squad, company, and battalion; school of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet-exercise.

Text-book.—United States Infantry Tactics.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States ship Santee.

MORTAR-PRACTICE.

FENCING.—Exercise with small-swords and broad-swords.

CADET-MIDSHIPMEN—COURSE OF INSTRUCTION.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and solution of equations of the first and second degrees; reduction and transformation of surd quantities; proportion; progressions; summation of series; nature and construction of logarithms; and the theory of equations.

GEOMETRY.—Plane and solid.

TRIGONOMETRY.—Analytical investigation of trigonometrical formulas, and application to the solution of all the cases of plane and spherical trigonometry; construction and use of trigonometrical tables.

APPLICATION OF ALGEBRA AND TRIGONOMETRY.—Mensuration of planes and solids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in geometry, and the applications of this method, particularly to the projections of the sphere.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of general equations of the second degree, involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections; Bowditch's Tables.

ELECTIVE COURSES.

In addition to the above, cadets of the third and fourth classes who display capability in mathematics are permitted to take an advanced course. The following are the elective courses for 1875-76:

Fourth class.—Todhunter's Algebra and Theory of Equations, and curve-tracing.

Third class.—The elements of the differential calculus, with applications to trigonometry and geometry of two dimensions.

DEPARTMENT OF STEAM-ENGINEERY.

MARINE ENGINES.—The classification of marine steam-engines, with their various arrangements. The study of details, and of the instruments and apparatus of marine service in connection with steam-engines. The varieties of valve-gear, of steam generators, of propelling-instruments, condensers, distillers, and pumps. The principles followed to insure strength in construction.

PRACTICAL EXERCISES.—The management of engines and boilers in operation, care, preservation, and adjustment of marine engines. The use of fuel. The use of the indicator and the interpretation of indicator-diagrams. Methods of computing power and the evaporation, and of determining the incidental losses incurred and which affect the power. The duties of the engine-room watch. The arrangements and disposition of the engineer-force on shipboard.

Text-books.—Bourne's Catechism of the Steam-Engine; King's Practical Notes on the Steam-Engine.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments, especially those used for determining terrestrial latitudes and longitudes.

Text-book.—C. J. White's Astronomy.

NAVIGATION.—Theory and practice of navigation, the latter including instructions to the duties of the navigator, the use of navigating-instruments, and their construction with the solution of problems and the use of tables.

Text-book.—Coffin's Navigation.

SURVEYING.—The form of the earth, with special reference to the construction of charts; explanation of geodetical surveys; the solution of problems in nautical surveying; and practical work in surveying and constructing charts.

Text-book.—Jeffers's Marine Surveying.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima, and the tracing of curves; the methods of integration, and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work, and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriiform fluids.*—Laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum-analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

CHEMISTRY.—General chemistry.

METEOROLOGY AND CLIMATOLOGY.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; sensible and insensible caloric; effects of heat; instruments used for the measurement of heat; thermo-dynamics.

Text-books.—Rice and Johnson's Elements of the Differential and Integral Calculus, with lectures; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; Stewart's Elementary Physics; Ganot's Physics (Atkinson's translation); Eliot and Storer's Manual of Chemistry; Eliot and Storer's Chemical Analysis; Maxwell's Theory of Heat; Jenkin's Magnetism and Electricity.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.

International law: origin and growth of the science; rights and duties of nations; in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; extradition; duties of ministers, consuls, and naval commanders; confiscation of enemy's property and debts; embargoes; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii*; rights and duties of neutrals; law of contraband; law of blockade; right of search; ship's papers; truces, passports, and treaties of peace; offenses against the law of nations; piracy; slave-trade.

Outlines of maritime law.

Lectures.

Text-book.—Kent's Commentaries, vol. 1.

HISTORY.—Origin and growth of the science of history; sources of historical information; outlines of history, from the earliest times to the present; the history of the Roman Empire, and of the states of Western Europe, from 1449 to the present; the progress of civilization, from the earliest times to the present; the history of the United States; lectures.

Text-books.—Freeman's General Sketch of History, with Mitchell's Ancient Atlas and Johnston's Historical Atlas; Eliot's History of the United States, with Appleton's and Mitchell's Modern Atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation of English; progress from the synthetic to the analytic forms of speech; character and course of inflexional development. Etymology; inflexional changes since the conquest. Syntax; analysis of sentences.—Readings from classical authors, with applications of the principles of grammar, and exercises in analysis and in tracing the etymological meaning of words.—Classification of words; definition of words by usage and by derivation; synonyms; force of the common prefixes, affixes, and roots; laws of change in the meaning of words by contraction, extension, and amelioration.—Relation between spoken and written language; faults in diction, and their remedies. Metaphor as the basis of language. Selection and arrangement.—Elementary principles of reasoning; the sources of knowledge and of error; induction and deduction; errors in reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Fasquelle's French Grammar; Howard's Aid to French Composition; Prud'homme's French Nautical Phrases; Erckmann-Chatrian's *Le Conscrit*; Roget's Spanish Manual; Tolon's Reader.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the cadets are arranged in four classes, each class pursuing the course for the year.

PROGRAMME OF STUDIES FOR CADET-MIDSHIPMEN.

The time devoted to daily recitations is divided into three periods, designated thus: (1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m. Practical exercises begin on Saturdays at 10.45 a. m., and on all other days except Sundays at 4 p. m.

First term: September 20, 1875, to January 29, 1876.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	{ [M. T. W. Th. F.] (2) [S.] (1) [once a week]	Algebra and Geometry.
English Studies, History, and Law.....	{ [M. T. W. Th. F.] (1) 1st division, [M. T. Th.] (3)	English and History.
Modern Languages.....	{ 2d division, [M. W. F.] (3) 1st division, [W. F.] (3)	Fasquelle's Grammar.
Drawing.....	{ 2d division, [T. Th.] (3)	Free Drawing.

First term : September 20, 1875, to January 20, 1876—

Department.	Periods.	
THIRD CLASS—SECOND YEAR.		
Mathematics.....	[M. T. W. Th. F.] (1)	T
English Studies, History, and Law	Once a week.....	
Physics and Chemistry.....	[F.] (3)	
Modern Languages.....	[M. F.] (2) [W.] (3)	History and Rhetoric.
	[T. W. Th.] (2)	Elementary Physics.
	[T. Th.] (3)	Fasquelle's Grammar and French Composition.
Drawing.....	[M.] (3) [S.] (1)	Sketching.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	[S.] (1)	Luce's Seamanship.
Ordnance and Gunnery.....	[M.] (3) [F.] (2)	Ship-Building.
Astronomy, Navigation, and Surveying.	[Th.] (3)	Infantry-Tactics.
Physics and Chemistry.....	[T.] (3) [W. Th.] (2)	Astronomy.
English Studies, History, and Law	[M. T. W. Th. F.] (1)	Applied Mathematics.
Modern Languages.....	Once a month.....	Composition.
	[M. T.] (2) [W. F.] (3)	Nautical Phrase Book and Grammar.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	[T. Th.] (3)	Luce's Seamanship.
Ordnance and Gunnery.....	[T.] (2) [W.] (3)	Ordnance and Armor.
Steam-Engineering.....	[W. Th.] (2) [F.] (1)	Marine Engines.
Astronomy, Navigation, and Surveying.	[M. T. W. Th.] (1)	Navigation and Surveying.
Physics and Chemistry.....	[M. F.] (2) [S.] (1)	Light and Heat.
Modern Languages.....	[M. F.] (3)	Spanish.

Second term : January 31, 1876, to June 20, 1876.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	Once a week.....	Elective Course.
Modern Languages.....	[M. T. W. Th. F.] (1)	English and History.
	1st division, [M. T. Th.] (3)	Fasquelle's Grammar.
	2d division, [M. W. F.] (3)	
Drawing.....	1st division, [W. F.] (3)	Topography.
	2d division, [T. Th.] (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics.....	[M. T. W. Th. F.] (1)	Analytical Geometry and Descriptive Geometry.
Physics and Chemistry.....	Once a week.....	Elective Course.
English Studies, History, and Law	[M.] (3)	Descriptive Geometry.
Modern Languages.....	[T. Th. F.] (2)	Chemistry.
	[M. W.] (2) [S.] (1)	History and Rhetoric.
	[T. W. Th. F.] (3)	Fasquelle's Grammar and French Composition.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	[T. Th.] (3)	Luce's Seamanship.
Ordnance and Gunnery.....	[F.] (2)	Naval Tactics.
Physics and Chemistry.....	[T. Th.] (2)	Ordnance-Instructions.
	[M. T. W. Th. F.] (1)	Applied Mathematics and Mechanics.
English Studies, History, and Law	[M. W.] (2) [S.] (1)	Electricity.
Modern Languages.....	Once a month.....	Composition.
	[M. W. F.] (3)	Spanish.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	[M. W.] (2)	Luce's Seamanship.
Ordnance and Gunnery.....	[T. S.] (1)	Naval Architecture.
Steam-Engineering.....	[M. T. Th.] (3)	Ordnance and Armor.
Astronomy, Navigation, and Surveying.	[W. F.] (2) [Th.] (2)	Marine Engines.
English Studies, History, and Law	[M. W. Th. F.] (1)	Navigation and Surveying.
	[T. F.] (2)	Public Law.

Ter COURSE OF INSTRUCTION FOR CADET-ENGINEERS.

Job
y

First class of 1875-'76.

Differential calculus; integral calculus; mechanics; hydrostatics; descriptive chemistry; analytical chemistry; heat; electricity and electrical measurements; French; steam-engineering (practical and theoretical); mechanical drawing.

Practical exercises in steam-engineering, infantry-tactics, and field-artillery.

The course of instruction for Cadet-Engineers during the first and second years will be the same as for the Cadet-Midshipmen, except the substitution of exercises in steam-engineering for those of the Cadet-Midshipmen in seamanship, great guns, and boat-howitzers.

During the third and fourth years, the Cadet-Engineers will receive an extended course of instruction in mechanics and physical measurements, in the designing and fabrication of machinery, and in the construction and use of marine engines. Seamanship, gunnery, naval and infantry tactics, and navigation will be omitted. In other subjects, the course for the Cadet-Engineers will be the same as for the Cadet-Midshipmen.

Text-books.—Bourne's Hand-Book of the Steam-Engine; Warren's Elements of Mechanical Drawing; Rankine's Steam-Engine and other Prime Movers; Eliot and Storer's Qualitative Chemical Analysis. The other text-books used by the Cadet-Engineers are the same as those used by the Cadet-Midshipmen.

PROGRAMME OF STUDIES FOR CADET-ENGINEERS.

The time devoted to daily recitations is divided into three periods, indicated thus: (1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m.

Practical exercises begin on Saturdays at 10.45 a. m., and on all other days except Sundays at 4 p. m.

First term: September 20, 1875, to January 29, 1876.

Department.	Periods.	Subject.
FOURTH CLASS—FIRST YEAR.		
Mathematics	{ [M. T. W. Th. F.] (2) [S.] (1) Once a week	Algebra and Geometry. Elective Course.
Steam-Engineering	{ 1st division, [W. F.] (3) 2d division, [T. Th.] (3)	Mechanical Drawing.
English Studies, History, and Law	[M. T. W. Th. F.] (1)	English and History.
Modern Languages	{ 1st division, [M. T. Th.] (3) 2d division, [M. W. F.] (3)	Fasquelle's Grammar.
THIRD CLASS—SECOND YEAR.		
Mathematics	{ [M. T. W. Th. F.] (1) Once a week	Trigonometry and Descriptive Geometry.
Steam-Engineering	{ [F.] (3) [M.] (3) [S.] (1)	Elective Course. Descriptive Geometry.
Physics and Chemistry	[T. W. Th.] (2)	Mechanical Drawing.
English Studies, History, and Law	[M. F.] (2) [W.] (3)	Elementary Physics.
Modern Languages	[T. Th.] (3)	History and Rhetoric. Fasquelle's Grammar and French Composition.
SECOND CLASS—THIRD YEAR.		
Seamanship	[M.] (3) [F.] 2	Ship-Building.
Steam-Engineering	{ [Th.] (3) [T.] (3) [Th.] (2)	Mechanical Drawing.
Physics and Chemistry	{ [W.] (2) [S.] (1) [M. T. W. Th. F.] (1)	Fabrication of Machinery. Marine Engines.
English Studies, History, and Law	Once a month	Applied Mathematics.
Modern Languages	[M. T.] (2) [W. F.] (3)	Composition. Nautical Phrase Book and Grammar.
FIRST CLASS—FOURTH YEAR.		
Steam-Engineering	{ [T.] (2) [Th.] (3) [M.] (1) [W.] (1)	Fabrication of Machinery.
Astronomy, Navigation, and Surveying	{ [T. Th. F.] (1) [T.] (3) [W. Th.] (2)	Designing of Machinery. Mechanical Drawing.
Physics and Chemistry	{ [W.] (3) [M. F.] (2) [S.] (1)	Astronomy.
Modern Languages	[M. F.] (3)	Mechanics. Light and Heat. Spanish.

Second term : January 31, 1876, to June 20, 1876.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	{ [M. T. W. Th. F.] (2) S. (1)	Algebra and Geometry.
	Once a week	Elective Course.
Steam-Enginery	{ 1st division, [W. F.] (3)	Mechanical Drawing.
	2d division, [T. Th.] (3)	
English Studies, History, and Law	{ [M. T. W. Th. F.] (1)	English and History.
Modern Languages	{ 1st division, [M. T. Th.] (3)	Fasquelle's Grammar.
	2d division, [M. W. F.] (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics	{ [M. T. W. Th. F.] (1)	Analytical Geometry and Descriptive Geometry.
	Once a week	Elective Course.
Physics and Chemistry	{ M. (3)	Descriptive Geometry.
	[T. Th. F.] (2)	Chemistry.
English Studies, History, and Law	{ [M. W.] (2) S. (1)	History and Rhetoric.
Modern Languages	{ [T. W. Th. F.] (3)	Fasquelle's Grammar and French Composition.
SECOND CLASS—THIRD YEAR.		
Steam-Enginery	{ [Th.] (2)	Mechanical Drawing.
	[T.] (3) [F.] (2)	Fabrication of Machinery.
	[T.] (2) [Th.] (3)	Marine Engines.
Physics and Chemistry	{ [M. T. W. Th. F.] (1)	Applied Mathematics and Mechanics.
	[M. W.] (2) [S.] (1)	Electricity.
English Studies, History, and Law	{ Once a month	Composition.
Modern Languages	{ [M. W. F.] (3)	Spanish.
FIRST CLASS—FOURTH YEAR.		
Seamanship	{ [T. S.] (1)	Naval Architecture.
	[F.] (1)	Marine Engines.
Steam-Enginery	{ [M.] (2) [Th.] (3)	Fabrication of Machinery.
	[W.] (1)	Designing of Machinery.
Physics and Chemistry	{ [M. Th.] (1) W. (2)	Mechanical Drawing.
	[T.] (3) [Th.] (2)	Mechanics.
English Studies, History, and Law	{ [M. W. F.] (3)	Physical Measurements.
	[T. F.] (2)	Public Law.

EXAMINATION-PAPERS-1874-75.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—Time allowed, five hours.

1. Simplify $a - \left[5b - \left\{ a - (5c - (2c - b)) + 2a - (3b - (c - 2b)) \right\} \right]$.

Resolve each of the following quantities into its factors:

$a^2 - x^2$, $a^3 + x^3$, $x^2 + (a + b)x + ab$, $x^3 + 16x + 63$, $x^3 - 7x^2 - 144$, $x^3 + 4x^2 + 2x$ — and separate each of the quantities $x^4 + 4$ and $x^4 + y^4$ into two trinomial factors.

2. Find the least common multiple of $x^2 - y^2$, $x^3 - y^3$, and $x^3 + y^3$.

Simplify—

$$\frac{2}{x-4} - \frac{x-3}{x^2-4x+16} + \frac{x^2}{x^3+64}$$

Add together—

$$\frac{b}{(a-b)(a-c)} \text{ and } \frac{a}{(b-a)(b-c)}.$$

Simplify—

$$\left\{ \frac{a+b}{a-b} + \frac{a-b}{a+b} \right\} \div \left\{ \frac{a+b}{a-b} - \frac{a-b}{a+b} \right\}.$$

3. Find the value of—

$$\frac{x^2 - 7x + 12}{x^2 + x + 20} \text{ when } x = 3, \text{ when } x = 4, \text{ and when } x = 5.$$

Find the value of—

$$\left\{ \frac{x-a}{x-b} \right\}^3 - \frac{x-2a+b}{x+a-2b} \text{ when } x = \frac{a+b}{2}.$$

4. Solve the equations—

$$\frac{7x+5}{6} - \frac{5x+6}{4} = \frac{8-5x}{12}, \quad \frac{6x+8}{4x+1} - \frac{2x+38}{x+12} = 1,$$

and

$$\frac{mx-a-b}{nx-a-b} = \frac{mx-a-c}{nx-b-d}$$

5. Solve the equations—

$$\begin{array}{l} 3x + 4y = 18, \\ 4x + 3y = 17, \end{array} \quad \begin{array}{l} \frac{x}{a+b} + \frac{y}{a-b} = 2a, \\ \frac{x-y}{2ab} = \frac{x+y}{a^2+b^2}, \end{array} \quad \begin{array}{l} 5x - 6y + 4z = 15, \\ 7x + 4y - 3z = 12, \\ 2x + y + 6z = 46. \end{array}$$

6. Divide the number n into two such parts that the quotient of the greater by the less may be Q , with a remainder R . A and B can do a piece of work in a days, A and C in b days, and B and C in c days. Find the time in which each can do it alone.

7. Extract the square root of 314.16 to three decimal places. Extract the cube root of .0064 to three decimal places. Extract the cube root of 3.38 to four decimal places. Write the formula for $(x+y)^m$ to five terms. Write the n th term of this formula. Develop $\sqrt[3]{x^3 - x^2}$ to five terms.

8. Divide—

$$64x^{-1} + 27y^{-2} \text{ by } 4x^{-\frac{1}{2}} + 3y^{-\frac{1}{3}}.$$

Multiply—

$$x^4 + x^2 + 1 \text{ by } x^{-\frac{1}{2}} + x^{-\frac{2}{3}} + 1.$$

Extract the square root of—

$$(x + x^{-1})^2 - 4(x - x^{-1}).$$

Reduce the following fractions to equivalent forms, with rational denominators:—

$$\frac{\sqrt{-1} + \sqrt{2}}{2 - \sqrt{2}}, \quad \frac{2 + \sqrt{3}}{1 - \sqrt{2} + \sqrt{3}}, \quad \text{and} \quad \frac{1 + \sqrt[3]{3}}{1 - \sqrt[3]{3}}.$$

Simplify—

$$\frac{1}{\sqrt{7 + 4\sqrt{3}}}.$$

9. Solve the equations—

$$\frac{x+2}{x+1} + \frac{x+1}{x+2} = \frac{13}{6}, \quad \sqrt{x+14} + \sqrt{x-14} = 14, \quad x^4 - 13x^2 + 36 = 0,$$

and—

$$2\sqrt{-2x+1} + x^2 = 23 + 2x.$$

Find a trinomial which will exactly divide $y^4 + y^2 + 1$.

10. Solve the equations—

$$\left. \begin{aligned} x + y + \sqrt{x+y} &= 12 \\ x^2 + y^2 &= 45 \\ \frac{x}{a} + \frac{y}{b} &= 1 \\ x + \frac{b}{y} &= 4 \end{aligned} \right\},$$

and

$$\left. \begin{aligned} \sqrt{x+y} + \sqrt{x-y} &= \sqrt{a} \\ \sqrt{x^2+y^2} + \sqrt{x^2-y^2} &= b \end{aligned} \right\}.$$

ANNUAL EXAMINATION.

JUNE, 1875.—Time allowed, five hours.

[Starred * questions may be omitted by lower sections.]

1. Write the square root of each of the following expressions: $12 - 6\sqrt{3}$, $39 + 12\sqrt{3}$, $15 - 4\sqrt{11}$. When is it possible to simplify such an expression as $\sqrt{a \pm \sqrt{b}}$?

Simplify—

$$\frac{1 + \sqrt{-1}}{1 - \sqrt{-1}} \cdot \sqrt{-1}.$$

Find the numerical value of $\frac{+\sqrt{3}}{2 - \sqrt{3}}$ to four decimal places.

*Reduce $\frac{a^{\frac{1}{2}} + b^{\frac{1}{2}}}{a^{\frac{1}{2}} - b^{\frac{1}{2}}}$ to an equivalent form in which the denominator is rational, and negative exponents do not occur.

2. Prove that the equation $x^2 + px + q = 0$ has two roots and no more. Find an ex-

pression for the sum of the roots and for their product. If the roots are equal, what is the relation between p and q ? Separate $x^4 + 16$ into two quadratic factors.

* If $x^2 + px + q$ and $x^2 + rx + s$ have a common divisor, what is the relation between p, q, r , and s ?

3. Solve the equations—

$$\begin{aligned} & \frac{a}{b+x} + \frac{a}{b-x} = \frac{c}{1} \\ & \frac{1}{x^2-3x} + \frac{1}{x^2+4x} = \frac{9}{8x} \\ & x^3 - ax + \frac{b}{2}(x+a-b) = 0, \\ & * \frac{x^2}{a^{\frac{1}{2}} + b^{\frac{1}{2}}} - (a^{\frac{1}{2}} - b^{\frac{1}{2}}) = \frac{1}{(ab^2)^{-\frac{1}{2}} + (a^2b)^{-\frac{1}{2}}}. \end{aligned}$$

4. Solve the equations—

$$\begin{aligned} & \left. \begin{aligned} 4xy &= 96 - x^2y^2 \\ x + y &= 6 \end{aligned} \right\}, \\ & \left. \begin{aligned} x^2 + y^2 - x - y &= 78 \\ x + y + xy &= 39 \end{aligned} \right\}, \\ & * \left. \begin{aligned} \frac{x + \sqrt{x^2 - y^2}}{x - \sqrt{x^2 - y^2}} &= 4\frac{1}{2} - \frac{x - \sqrt{x^2 - y^2}}{x + \sqrt{x^2 - y^2}} \\ x(x+y) &= 52 - \sqrt{x^2 + xy + 4} \end{aligned} \right\}. \end{aligned}$$

5. Find y in terms of x from the equation $y^3 - 4xy + 6y - 5x^2 - 30x + 27 = 0$.

Find x in terms of p, e, m , and c from the equations $x^2 + y^2 = (p + cx)^2, y = mx + c$.

* Find what the value of c must be in order that the two values of x may coincide and find the corresponding value of x in terms of p and m when $e = 0$.

6. Write the development of $(2a - 3c)^6$. Develop $(a^2 - x^2)^{-\frac{1}{2}}$ to five terms. Write the p th term of the latter development.

* Apply the above development to calculate the value of $\frac{1}{\sqrt{99}}$ to five decimal places.

7. Deduce a formula for the sum of an arithmetical progression in terms of a, d, n .

Deduce a formula for the sum of a geometrical progression in terms of a, r, n . Find the sum of n terms of the series 3, 5, 7, &c. Find the sum of the geometrical progression $2 + \sqrt{3}, 2 - \sqrt{3}, \&c.$, to infinity.

* The p th term of an arithmetical progression is P , and the q th term is Q ; find the first term and the sum of n terms.

8. What is a logarithm? Explain what is meant by the modulus. Give the values of the bases and moduli of the common and Napierian systems. Find the value

$\sqrt{\frac{a \cdot b \cdot c \cdot d}{e \cdot f \cdot g}}$, given $a = .003589, b = .00015785, c = 3401.5, d = 15.785, e = 22, f = 25.79, g = 25790000$.

* Prove that $\log_a x = \log_b x \log_a b$.

9. Form the equation whose roots are $2 \pm \sqrt{3}$ and $3 \pm \sqrt{5}$. Transform the equation $x^4 - 8x^3 + 18x^2 - 15x + 14 = 0$ to another whose roots are less by unity. Transform the same equation to another wanting the second term, and also to one wanting the third term. Find all the roots of $x^6 + 1 = 0$.

* Find a root of the equation $x^3 - 2x - 5 = 0$ to five decimal places.

10. Find n from the formula—

$$n = \frac{\log l - \log [lr - (r-1)S]}{\log r} + 1,$$

given $r = 1.03, l = 70.927, S = 419.72$. Find the value of n , given $r = 2, n = 3.1416$.

* Deduce the formula for the number of shot in a triangular pile of n courses.

GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1875.—Time allowed, five hours.

1. Define *straight line*, *plane surface*, *right angle*, *quadrilateral*. Name and define the different classes of quadrilaterals, giving a diagram of each. Prove that the sum of the angles of any plane triangle is two right angles. Prove that the three bisectors of the angles of a triangle meet in a point.

2. Explain the terms *chord*, *arc*, *sector*, *segment*, *secant*, *tangent*. Prove that an angle inscribed in a circle is measured by one-half the intercepted arc. Prove that, if through a fixed point within a circumference a chord be drawn, the product of the two segments of the chord is constant.

3. Write formulas for the areas of triangles, trapezoids, and circles, and for the circumference of the circle. What is the diameter of a circle whose area is equal to that of three circles whose diameters are 6 inches, 8 inches, and 24 inches respectively? A certain arc is equal in length to the radius; find its length in degrees, minutes, and seconds.

4. Inscribe a regular decagon in a circle whose diameter is 3 inches, and prove the construction. Find an algebraic expression for the length of a side of the decagon, denoting the radius of the circle by a .

5. Prove that the square described upon the hypotenuse of a right triangle is equivalent to the sum of the squares described on the other two sides. Prove that a line drawn from the vertex of the right angle to the middle of the hypotenuse is equal to one-half the hypotenuse.

6. Define *polygon*, *regular polygon*, *apothegm*. Denoting the side of the given polygon by a , find expressions for (1) the diagonal of a square, (2) the altitude of an equilateral triangle, (3) the radius of a circle circumscribed about a regular hexagon, (4) the radius of a circle circumscribed about an equilateral triangle, (5) the radius of a circle inscribed within an equilateral triangle.

7. Define *prism*, *conical surface*, *spherical triangle*, *tri-rectangular triangle*. Write formulas for the volumes and surfaces of the cone, cylinder, and sphere, the volume of the frustum of a cone, and the surface of a zone. Prove that a triangular pyramid is one-third of a triangular prism which has the same base and altitude.

8. State and prove the relation between the parts of a spherical triangle and those lying opposite to them in the polar triangle. Show that the area of a spherical triangle is measured by the spherical excess. If $1''$ of spherical excess represents one square mile of surface, what is the diameter of the sphere?

9. The section of a ditch is a trapezoid, of which the parallel sides are 7 feet and 1 foot respectively, and the depth is 6 feet. If its length is a quarter of a mile, how many cubic yards will it contain? What geometrical figure is the ditch? What is the depth of water when the ditch is half full?

10. A heavy sphere is placed in a hollow cone of revolution, the radius of the base of the cone being $\frac{10}{\sqrt{3}}$ inches, and the axis 10 inches. The axis of the cone is vertical and the vertex downward. The space intermediate to the two bodies is filled with water, which just covers the sphere as it begins to flow over. If the sphere be slowly withdrawn, to what depth will the water sink?

THEORY OF EQUATIONS.

ELECTIVE COURSE.

Cadet-Midshipmen J. H. Fillmore, J. H. Glennon, C. N. Atwater, T. S. Rodgers, J. G. Quinby, and H. S. Knapp.

Cadet-Engineers I. N. Hollis, F. J. Schell, and G. H. Bull.

JUNE 5, 1875.—Time allowed, five hours.

1. Prove that when $f(x)$ is divided by $x - c$ the remainder is $f(c)$. Find the value

of $x^5 - 10x^4 - 9x^3 - 8x^2 - 7x + 1$ when $x = 11$. Find expressions for the sums of the squares, cubes, and fourth powers of the roots of the equation $f(x) = 0$ in terms of the coefficients.

2. Transform the equation $x^2 + qx + r = 0$ to another whose roots are the squares of the differences of the roots of the given equation; from the result find the condition that the original equation may have equal roots; find also the condition for imaginary roots. Prove that the equation $x^4 + ax^2 + b = 0$ cannot have equal roots.

3. Denoting the roots of the equation $x^3 + 19x + 30 = 0$ by a , b , and c , find the equation whose roots are $a(b + c)$, $b(a + c)$, and $c(a + b)$. The roots of the equation $x^4 - 15x^3 + 70x^2 - 120x + 64 = 0$ are in geometrical progression; find them.

4. Apply Sturm's theorem to find the number and situation of the real roots of the equation $x^4 - 8x^3 - 24x + 7 = 0$, and find the greatest root to six decimal places by Horner's method.

5. Apply La Grange's method to the equation in the preceding question, making two approximations to the value of the greatest root, and thence solve the equation completely.

6. State in general terms the three methods employed for the solution of biquadratic equations, and apply one of these methods to solve the equation of Question 4.

7. Construct on the same axes the loci of the two equations—

$$x^2 - xy - 3x - 2y^2 + 12y - 18 = 0$$

and—

$$4y^2 - 4xy + 5x^2 - 40x - 16y + 96 = 0.$$

8. Find the maximum cone that may be inscribed in a given cone, the vertex of the inscribed cone to be at the centre of the base of the given one. Trace the curves used in the solution.

9. Trace the locus of the equation $y^2 = ax^2 + bx^3$, regarding b as positive, and making a successively positive, zero, and negative. Trace the locus of the equation $y^2 = ax^2 - x^3$.

10. Trace the locus of the equation $y^4 + x^4 - 2a^2y^2 - 2b^2x^2 + b^4 = 0$, determining the co-ordinates of all the points at which a tangent to the curve is parallel to one of the co-ordinate axes.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY 28, 1875.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

1. Place, geographically and ethnologically: 1. Provençal. 2. Jutes in England [450 A.D.]. 3. Hellenes. 4. Visigoths [after 410]. 5. Lithuanian. 6. Magyar. 7. Wend. 8. Breton.

2. (a) "In the early state of things, the city is always in advance of the great kingdom." Explain this, and apply it to the case of Greece.

(b) "The establishment of the Roman Empire was not a formal revolution." Explain. How did the establishment of the empire differ from its abolition, in this respect?

*2. Why was the Peloponnesian War a war of races and principles as well as of states? How was the constitution of the empire modified by Diocletian?

3. Venice and Florence, XIII. century. Compare.

*3. Name the two families that successively held the chief power in Milan in the XIV. century, and tell how the duchy was obtained in the case of each.

4. Name in order the Swabian emperors, and show by a genealogical table their connection with the family that preceded them.

4. What four German tribes supplied Italy with rulers in the period 476-800? What the principal name in each line of rulers?

5. "For the very reason that the French kings had once had much less power than the emperors or the English kings, they came in the end to have much more power than either of them." Explain fully, showing how the continuance of the national assemblies and the introduction of the feudal system in each country helped to reduce this result.

6. Give the circumstances connected with the French acquisition of (1) Normandy, (2) Toulouse, (3) Algiers, (4) Corsica.

7. What German prince was the especial protector of Luther? How does it happen that the successors of this prince are now Roman Catholics, while their subjects are Protestants?

8. The Scots gained their liberty and the establishment of their religion by the revolution that enslaved Ireland." Explain fully, giving date.

9. Apart from religious considerations, what reason had England for sympathizing with the Protestant side in the Thirty Years' War?

710, 732, 1453, 1492, 1571. Connect.

10. What disposition was made of the Netherlands at the Congress of Vienna, and how has the arrangement been modified since that time? [Give dates.]

Describe briefly the Zollverein.

11. What change was made in 1837 in the political condition of Hungary?

Compare the revolutions of 1830, 1848, and 1851.

12. During the first half of the XVI. century, "there was a long rivalry between France and Spain, which was in some sort a continuation of the dispute between the houses of Anjou and Aragon for the throne of Sicily, as that was a continuation of the older disputes between Guelphs and Ghibelins." Explain in full.

13. Draw a map of central and western Europe as settled in 1815, marking the position [or boundaries] of the following:

1. Leipzig.	7. Austerlitz.	13. Luneville.
2. Sileswick.	8. Saxony.	14. Avignon.
3. Hamburg.	9. Holstein.	15. Netherlands.
4. Bern.	10. Bremen.	16. Gibraltar.
5. Pressburg.	11. Waterloo.	17. Köln.
6. Frankfurt.	12. Trafalgar.	18. Arras.

HISTORY OF THE UNITED STATES.

ANNUAL EXAMINATION.

JUNE 12, 1875.—Time allowed, five hours.

[Starred (*) questions are alternatives.]

1. When, where, and how was the first representative assembly organized in America?

*1. 1629, 1634, 1692; Massachusetts charter.

2. (1) Charter government; (2) Writs of assistance; (3) American association; (4) Hartford convention; (5) American anti-slavery society; (6) Crittenden compromise. Take three.

3. What form of government prevailed in each of the thirteen colonies in 1740?

*3. State the transfers undergone by Louisiana and Florida between 1760 and 1820, giving dates.

4. State what was accomplished by each of the following treaties: Prussia, 1785; Jay's treaty; Guadalupe Hidalgo; Japan, 1852; Washington, 1871.

5. Name six naval victories in the war of 1812, giving the names of the vessels engaged and the victorious commander in each case.

Jones's cruise in the Bon Homme Richard.

*5. April 19, 1775; April 19, 1861.

Affair of the Chesapeake and Leopard.

6. What compromise settled the difference of opinion between the large and small States in the Federal Convention in regard to equality of votes? How did the first Congress under the Constitution provide a revenue?

*6. What sides were taken by different sections of the country on the tariff question and what was the cause of the division? What action was taken by South Carolina and on what grounds?

7. Show the connection between the legislation under which Missouri was admitted as a State and that under which Kansas was organized as a Territory.

8. Connect the seventh annual message of President Monroe in 1823 with the discovery of Mexico by the French.

9. What position was taken by the minister of the United States at the court of Great Britain in regard to the construction of the rams at Liverpool?

*9. Career of the Alabama.

10. Fix the position of—1. Salem. 2. Cape Fear River. 3. Fort Casimir. 4. Cape Breton Island. 5. Acadie. 6. Sault Ste. Marie. 7. Fort Du Quesne. 8. Plattsburgh. 9. Princeton. 10. Chattanooga.

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY 25, 1875.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

PUNCTUATION.

1. State the distinction in use between the apostrophe and period in connection with abbreviated words.

Give the rule for the position of an interrogation-point coming at the same place with quotation-marks.

ENGLISH.

2. Classify the languages comprised in the Teutonic family.

In what two forms did the influence of the early Latin missionaries on the English language show itself?

*2. Describe the formation of a common literary dialect in England.

In what two ways did the influence of the classical revival show itself?

3. Explain the character of the change from the synthetic to the analytic stage of language.

4. Define any five of the following:—

1. Adjective noun. 2. Passive voice. 3. Substantive noun. 4. Inflection. 5. Subjunctive. 6. Future-perfect tense. 7. Auxiliary verb.

5. Give the possessive, singular and plural, of—1. Wolf. 2. Hero. 3. Hoof. 4. Man. 5. Englishman. 6. Attorney. 7. Vanity. 8. Ox. 9. Cherub. 10. Fief. Beef.

6. Give the principal parts of the following verbs, with a full explanation in each case:—1. Rend. 2. Flee. 3. Fly. 4. Lay. 5. Lie. 6. Rise. 7. Raise. 8. Lose. Loose.

7. Explain the following etymologically:—1. Participle. 2. Sweetheart. 3. Egg. 4. Foundling. 5. Dukedom. 6. Airy. 7. Landscape. 8. Auctioneer. 9. Thank. 10. Analyze:—

"But now be ready, for I long full sore,
To hear the merry dashing of the oar,
And feel the freshness of the following breeze,
That sets me free, and sniff the rough salt seas."

Note all the words in the passage which can be used as different parts of speech. Illustrate their various uses.

1. Explain syntactically the words in italics in the following :—

"At length for intermission sake they led him
Between the pillars ; he his *guide* requested
(For so from *such* as nearer stood we heard,)
As *overtired*, to let him lean *awhile*
With both his arms on those two massy pillars
That to the arched roof gave main support.
He *unsuspicious* led him ; *which* when Samson
Felt in his arms, with head awhile inclined,
And eyes *fast fix't* he stood."

ENGLISH LESSONS.

ANNUAL EXAMINATION.

JUNE 12, 1875.—Time allowed, four hours.

[Starred (*) questions are alternatives.]

1. Explain the terms:—1. Synonyms. 2. General terms. 3. Hybrids. 4. Fine writing. 5. Periphrasis.

*1. Define the word *law*, using *custom* as a synonym.

2. State and explain the laws of change in meaning illustrated by the following words:—1. Cunning. 2. Table. 3. Minister. 4. Circumstance. 5. Idea. Take three.

3. Show why inexperienced writers naturally use the language of poetry in treating unfamiliar subjects.

*3. Show how obscurity may arise from the ambiguous use of pronouns.

4. Explain :—1. Personal metaphor. 2. Hyperbole. 3. Oratory. 4. Romance. 5. Ballad. 6. Dramatic poem.

How do scientific and non-scientific composition differ ?

5. When are incidents interesting in themselves ?

Why are the incidents in novels generally of a trivial character ?

6. Define : logic, deduction, false generalization, begging the question, proposition of identity, mathematical certainty.

7. What is the use of logic in literature ?

8. What is meant by saying that " a syllogism implies inclusion " ?

Distinguish between essentials and accidents.

9. " The sun of liberty is set ; Americans must light the lamp of industry and economy." Expand.

" Good seamen are not reckless men.

The captains of the Cunard steamers are good seamen."

Conclusion ? Draw diagram and explain. Tell which of the terms in the minor premise is distributed.

10. " The end of a true soldier's life is the welfare of his country.

But death is the end of a soldier's life.

∴ This death is necessary for the welfare of his country."

Explain any errors you may see. Point out the major premise, minor premise, major term, minor term, and middle term.

THIRD CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, JUNE, 1875.

I.

1. How is a stopper clapped on a fall ?

2. Fit a parbuckle ; state its use and the power gained.

5 N A

3. Measure for each pair of shrouds (lower) in the order they go over the main.
4. Reeve, cut, and fit the fore braces.
5. Make preparations for bending sails.
6. Transport a sheet-anchor from waist to bow.
7. Ship heads ENE. $\frac{1}{4}$ E. on the port tack; how will she head on the starboard

II.

1. How is a selvagee strap made? State its use.
2. Fit a reef tackle. State its use and the power gained.
3. Measure for mast-head pendants, fore, main, and mizzen.
4. Reeve, cut, and fit the main-braces.
5. Make up a lower studding-sail.
6. Make preparations for, and hoist out a launch on port side.
7. Ship heads SW. $\frac{1}{4}$ S. on the port tack; how will she head on the starboard

III.

1. What is a round seizing? How is it passed?
2. Fit a whip and runner. State its use and the power gained.
3. How are royal shrouds fitted?
4. Reeve, cut, and fit the crossjack braces.
5. Describe a foresail, and state how it is fitted.
6. Get a sheet-anchor ready for letting go.
7. Ship heads NNE. on the starboard tack; how will she head running two points on the port tack?

IV.

1. Make an eye-splice in a wire-rope.
2. Fit a two-fold purchase. State its use and the power gained.
3. Measure for the main-royal stay, stating its lead, place, and manner of setting.
4. Reeve, cut, and fit the fore-topsail braces.
5. Fit and bend a fore-trysail.
6. Describe and name the different parts of an anchor.
7. Ship heads N. $\frac{1}{4}$ W. on the port tack; how will she head running three points on the starboard tack?

V.

1. How is a cat's-paw made, and for what is it used?
2. Fit a sail tackle; state its use and the power gained.
3. State in what order the rigging goes over the fore-topgallant mast-head.
4. Reeve, cut, and fit the main-topsail braces.
5. Describe a topsail. How is it fitted for bending?
6. What is understood by ground-tackle?
7. Ship heads ESE. $\frac{1}{4}$ E. on the port tack; how is the wind?

VI.

1. How is a carrick-bend made? for what is it used?
2. Fit a top-tackle. State its use and the power gained.
3. State in what order the rigging goes over a top-gallant mast-head.
4. Reeve, cut, and fit the mizzen-topsail braces.
5. Describe and bend a spanker.
6. Make preparations for heaving up an anchor.
7. Ship heads N. $\frac{1}{4}$ E. on the starboard tack; how will she head on the port

VII.

1. How is the size of a rope indicated?
2. Fit a single whip. State its use and the power gained.
3. How are jib-guys fitted?
4. Reeve, cut, and fit the fore top-gallant braces.

Lash, rig, and raise sheers.

Describe how sheet-anchors are secured.

Ship heads S. $\frac{1}{2}$ E. on the port tack; how will she head on the starboard tack?

VIII.

How is a figure-of-eight knot made, and for what is it used?

Fit a stay-tackle. State its use and the power gained.

Describe the manner of measuring for standing rigging with fore-and-aft and m drafte.

Reeve, cut, and fit the main topgallant braces.

Fit and bend a fore topsail.

Make preparations for and hoist in a launch on the port side.

Ship heads NE. by E. $\frac{1}{2}$ E. on the starboard tack. How will she head on the port tack?

IX.

Describe euphroes. State their use.

Fit a truss-tackle. State its use and the power gained.

What is the running rigging of a ship?

Reeve, cut, and fit the mizzen topgallant braces.

How do you rattle down the lower rigging?

What is the length between the shackles of chain-cables? How are chain-cables stowed?

Ship heads NNW. $\frac{1}{2}$ W. on the starboard tack. How will she head on the port tack?

X.

1. Describe back-handed rope and state its use.

2. Fit a single Spanish burton. State its use and the power gained.

3. Measure for topgallant back-stays.

4. Reeve, cut, and fit the fore royal braces.

5. Get the main yard on board.

6. How do you know which end of a chain-cable to bend to the anchor? What is a mooring-swivel?

7. Ship heads SW. $\frac{1}{2}$ S. on the starboard tack. How will she head on the port tack?

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE-INSTRUCTIONS.

SEMI-ANNUAL EXAMINATION.

FEBRUARY, 1875.—Time allowed, four hours.

1. Give weights of guns, charges, projectiles, and bursting-charges for XV-inch, XI-inch, IX-inch, VIII-inch (6500), 32-pounder (4500); give the same and calibers, for 110-lbs, from Parrott 100-pounder to Dahlgren 12-pounder.

2. Station the crews for IX-inch and VIII-inch guns.

3. Station the crew at an XI-inch pivot-gun; "cast loose and provide;" give orders for working.

4. Give details of the construction and stowage of a magazine having two alleys.

5. Describe the inspection of the bore of an VIII-inch gun; verify the trunnions and adjust the reinforce-sight; give all the marks on a gun "passed."

6. Give rules complete for boarders, riflemen, sail-trimmers, &c., pumpmen, firemen, and pikemen.

7. Divide to cast loose IX-inch gun, and man both sides, full crews; shift left truck.

8. Station a crew for a XIII-inch mortar; give orders for working it.

9. Provide a division of IX-inch guns. Provide a division of VIII-inch guns.

10. Sketch a pivot-carriage and slide; number and name the parts.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

MONTHLY EXAMINATION.

DECEMBER 31, 1874.—*Time allowed, two and a half hours.*

[Answers to five questions required.]

1. Deduce formulas for the solution of the equation—

$$\tan(a+z) = m \tan z.$$

Find z from the equation—

$$2.325 \cos z + 13.45 \sin z = 4.327.$$

2. Deduce the formulas—

$$\tan^2 \frac{1}{2}x + 2 \cot x \tan \frac{1}{2}x - 1 = 0,$$

$$\tan^2 \frac{1}{2}x - 2 \cos x \tan \frac{1}{2}x + 1 = 0,$$

assuming only the fundamental formulas of plane trigonometry. What two cases there in the trigonometric solution of the equation $x^2 + px + q = 0$? Deduce formula for the solution of one of these cases.

3. Find
- x
- from the equation—

$$x^2 + 1.0895x - 6.8195 = 0.$$

4. State De Moivre's theorem, and demonstrate it for integral values of n (positive and negative). Apply the theorem to find the sine and cosine of $3x$ in terms of functions of x . What method may be used in writing the tangent of πx in terms of the tangent of x ?

5. What three cases are there in the trigonometric solution of the equation—

$$x^3 + ax + b = 0?$$

Deduce the formulas for the solution of the first case.

6. Solve the equation
- $x^3 + 6x^2 + x - 2 = 0$
- , deducing the necessary formulas.

SEMI-ANNUAL EXAMINATION.

JANUARY 25, 1875.—*Time allowed, five hours.*

[Any two questions may be omitted.]

1. Define *sine*, *versed sine*, *cosine*. State the limiting values of each of the trigonometric ratios. Given $y = \operatorname{cosec} x$, find the cosine and cotangent of x . Find the circular measure of $\sec^{-1} 3$. Find $\log \cotan$ of $11^\circ 15'$. Given $\sin x = \frac{1}{2}$, find the sine, cosine and tangent of $2x$ and of $3x$ without the tables.

2. Assuming the fundamental formulas (sine and cosine of $(x \pm y)$), deduce following:

$$\tan(x \pm y) = \dots\dots, \sin x + \sin y = \dots\dots,$$

$$\sin x - \sin y = \dots\dots, \cos x + \cos y = \dots\dots,$$

$$\frac{\sin x + \sin y}{\cos x + \cos y} = \dots\dots, \frac{\sin(x+y)}{\sin(x-y)} = \dots\dots.$$

Write the formulas for the sine, cosine, and tangent of $\frac{1}{2}x$, and deduce the formulas

$$\sin x = \frac{2 \tan \frac{1}{2}x}{1 + \tan^2 \frac{1}{2}x}, \quad \cos x = \frac{1 - \tan^2 \frac{1}{2}x}{1 + \tan^2 \frac{1}{2}x}.$$

3. A ship's mast is 126 feet in height from the truck to the water-line, and subtends an angle of $1^\circ 30' 30''$; find the distance of the ship. The altitude of a triangle is 100 feet, and the angles at the base are 30° and 45° ; find the sides and area *without tables*. A person standing on the bank of a stream observes the angle subtended by a tree on the opposite side to be 60° , and when he retires 40 feet from the stream the angle is 30° ; determine the height of the tree and the width of the stream without using tables.

4. Assuming the trigonometric ratios of 30° and 45° , find the sine, cosine, and tangent of 15° . Deduce the sine, cosine, and tangent of 18° . Find the tangent of $\left\{\sin^{-1} \frac{1}{2} + \cos^{-1} \frac{1}{2}\right\}$ without the tables. Find all values of x less than 2π which satisfy the equation $\sin 3x + \sin 2x = \sin x$.

5. Enunciate and prove each of the three theorems by which the solution of plane oblique triangles is effected.

6. Deduce formulas for the sine, cosine, and tangent of half an angle of an oblique plane triangle in terms of the sides. Deduce also a formula for the area in terms of the sides.

7. In an oblique triangle, given $A = 60^\circ$, $a = 10$, $b = 10\sqrt{2}$; find B and c by dividing the triangle into two right triangles, without using tables. Eliminate θ from the equations—

$$\begin{aligned} x \sin \theta + y \cos \theta &= a, \\ x \cos \theta - y \sin \theta &= b. \end{aligned}$$

8. Given $A = 54^\circ 30' 45''$, $a = 42.356$, $b = 51.234$. Solve the triangle.

9. From the deck of a ship sailing due east a light-house bore ENE. $\frac{1}{4}$ E., and after sailing 8 miles it was observed to bear N. by E. Find the distance of the light-house from the ship at the last observation, and find how near to it the ship passed.

10. Find z from the equation—

$$3 \cos z + 6 \sin z = 5.$$

Find the value of $x(\sin x)^{\cos x}$ when $x = \tan^{-1} \sqrt{2}$.

11. A person walking along a straight road observes the greatest elevation of a tower to be α ; from another straight road he observed the greatest elevation to be β . The distances of the points of observation from the intersection of the two roads are a and b . Find the height of the tower.

12. From a vessel, A , another vessel, B , bears N. α W. A steams a miles per hour; B steams b miles per hour, and steers N. β W. Show that in order to intercept B , A must steer N. $(\phi + \alpha)$ W.; ϕ being found from the equation $\sin \phi = \frac{b}{a} \sin (\beta - \alpha)$.

SEMI-ANNUAL EXAMINATION.

JANUARY 27, 1875.—Time allowed, five hours.

1. Prove that in any spherical triangle the cosine of either side is equal to the product of the cosines of the other two sides plus the continued product of the sines of those sides and the cosine of the included angle. Show that this theorem is true when the parts of the triangle are not restricted to values less than 90° . Apply the formula—

$$\cos^2 \frac{1}{2} A = \sin^2 \frac{1}{2} (B - C) \sin^2 \frac{1}{2} a + \sin^2 \frac{1}{2} (B + C) \cos^2 \frac{1}{2} a$$

to the polar triangle.

2. Deduce formulas in which the sine, cosine, and tangent of half an angle of a spherical triangle are expressed in terms of the sides.

3. Deduce all the formulas necessary for the solution of right spherical triangles, and state Napier's rules.

4. Deduce Napier's analogies.

5. Given $C = 90^\circ$, $B = 110^\circ 46' 20''$, $a = 115^\circ 38' 40''$; solve the triangle.

6. Given $L = 30^\circ 30' 40''$ N., $d = 19^\circ 20' 30''$ S., $h = 28^\circ 20' 30''$; find t , adapting the formula for $\sin^2 \frac{1}{2} A$ to this case.

7. Given $t = 2^\circ 30'$, $d = 12^\circ 30' 30''$ N., $L = 45^\circ 30' 30''$ N.; find h and Z .

8. Given $c = 90^\circ$, $A = 30^\circ 30' 30''$, $B = 110^\circ 30' 30''$; solve the triangle.

9. Given $B = 132^\circ 18' 30''$, $C = 139^\circ 44' 20''$, $c = 127^\circ 30' 10''$; solve the triangle, using Napier's rules.

10. With the same data as above solve the triangle, using Napier's analogies.

ANALYTICAL GEOMETRY.

MONTHLY EXAMINATION.

MAY 28, 1875.—*Time allowed, two and a half hours.*

1. Deduce the equation to the normal to the parabola, $y^2 = 4ax$, in terms of direction ratio of the normal.

Find an expression in terms of e for the tangent of the angle included between tangents drawn at the extremities of a parameter of the ellipse. Find the rect equation to the ellipse in terms of p and c , when the origin is taken at the intersection of these two tangents, and the co-ordinate axes remain parallel to those of the ellipse.

2. Find in terms of a , b , and c , the equation to a straight line which passes through the upper extremity of the right-hand parameter of the hyperbola $a^2y^2 - b^2x^2 = 0$ and also through the point where the tangent, at the nearest vertex, meets the transverse axis. Find the length of a perpendicular from the focus upon the line. What does the latter expression become when the hyperbola is rectangular? Prove that a line drawn from the focus to the hyperbola bisects the angle between the lines drawn from the foci to the point of contact.

3. The eccentricity of an ellipse is $\frac{1}{2}\sqrt{2}$; a parabola whose parameter is equal to the minor axis of the ellipse has the same vertex and axis; find the co-ordinates of the points of intersection of the two curves, taking the origin at the common vertex. Find the equations to those tangents to the hyperbola $a^2y^2 - b^2x^2 + a^2b^2 = 0$ which pass through the upper focus of its conjugate.

4. Find the equation to the tangent to $\sqrt{x} + \sqrt{y} = \sqrt{a}$ in terms of its direction ratio m ; and find the equation to the locus of the foot of the perpendicular let fall from the focus upon this tangent.

5. Two normals to the parabola $y^2 = 4ax$ meet at right angles; from the focus draw a perpendicular to the point of intersection, a distance equal to $\frac{1}{2}$ the parameter is measured toward the vertex. Prove that the straight line joining the end of this distance to the point of intersection is also a normal.

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, five hours.*

1. Find the angle between the lines $2y - x - c = 0$ and $3y + x - c = 0$. Find the length of the perpendicular from $(3, 5)$ upon $3y - 7x + 9 = 0$. Prove analytically that the three lines drawn from the vertices of a triangle to the middle point of the opposite sides meet in a point.

2. Deduce the formulas—

$$x = X \cos \alpha - Y \sin \alpha$$

$$y = X \sin \alpha + Y \cos \alpha$$

Find what the equation—

$$x^2 + y^2 + xy - 10x - 11y + 37 = 0$$

becomes when the origin is removed to the point $(3, 4)$ and the axes are turned through an angle of 45° .

3. Deduce the criterion by which we determine what conic is represented by the equation of the form $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. State what the equation may represent (1) when $B^2 > 4AC$; (2) when $B^2 = 4AC$; (3) when $B^2 < 4AC$. Show that when the axes are rectangular $\tan 2\alpha = \frac{B}{A-C}$, where α denotes the angle of rotation of an axis of the conic.

4. Deduce the equations of the tangent and normal to the parabola, each in terms of its own direction ratio. Prove that perpendicular tangents to the parabola intersect on the directrix. Find the equations to tangents to $y^2 = 4ax$ passing through $(-a, 0)$.

5. Define the ellipse, and deduce its rectangular equation in terms of the semi-axes. Deduce the rectangular and polar equations to the ellipse when the origin is taken at the left-hand focus. Find the equations to the locus of the foot of a perpendicular let fall from the focus of an ellipse upon the tangent.

6. Explain the terms *subtangent*, *subnormal*, *pole* and *polar*, *radical axis*. Of what points is the radical axis the locus? Deduce expressions for the subtangent and subnormal to the parabola and ellipse. Explain a method of constructing a tangent to any conic, (1) at a given point on the curve, (2) through a given point not on the curve; illustrate by diagrams.

7. Reduce the equation $y^2 - 2xy + x^2 - 6y - 6x + 9 = 0$ to its simplest form by transformation of co-ordinates. Construct the locus of the equation $y^2 + xy + x^2 + y + x - 5 = 0$, and find what the equation becomes when the conic is referred to its centre and axes.

8. Find the locus of the middle point of a line joining the extremities of two conjugate diameters of the ellipse. The abscissa of the focus of an hyperbola referred to its centre and axes is 5, and the equation to the tangent at a point whose ordinate is 4 is $4y - 5x + 16 = 0$; find the equation to the hyperbola.

9. Trace the loci of the equations—

$$\begin{aligned} y^2 &= x(x+1)(x+3), \\ x^4 - ax^2y + ay^3 &= 0, \\ r^2 &= \frac{a^2 \sin 3\theta}{\cos \theta} \end{aligned}$$

10. Two straight lines are drawn parallel to the major axis of an ellipse at a distance from it; prove that the part of any tangent intercepted between them will be divided by the point of contact into two parts subtending equal angles at the centre.

DEPARTMENT OF PHYSICS AND CHEMISTRY. CHEMISTRY.

ANNUAL EXAMINATION.

JUNE, 1875.—Time allowed, four hours.

1. Express by symbols the chemical change which results when sulphuric acid diluted with water is poured upon metallic zinc, and show how this experiment illustrates the essential characteristics of an acid. Write another reaction illustrating the same point,

2. What is meant by the allotropic forms of an element? Give all the examples you have had.

3. How is the molecular weight of bodies which can be readily volatilized determined, and upon what law does the process depend?

4. What information regarding the substance ammonia is condensed into the symbol NH_3 ?

5. Given sodium-carbonate and sulphuric acid, calculate the weight of acid necessary to produce 2.273 litres of carbon dioxide under normal conditions. Explain your work and analyze the reaction.

6. Iron-rust destroys sails. Charcoal destroys sewer-gases. Explain the action in these cases, and give other illustrations where this principle obtains.

7. Discuss the theory of the composition and use of gunpowder, and show the products of its combustion. Describe also the process of manufacture of nitro-glycerine, and show wherein lies the difference in properties of the two explosives.

8. What volume of hydrogen arsenide at 55°C . and 73 cubic metres can be obtained from 15 cubic metres of As. (sp. gr. 5.76)? Describe the properties of hydrogen-arsenide, giving its volume composition.

9. How is hydrochloric acid manufactured? Describe the substance fully.

10. Write the empirical, typical, and graphic formulas for the following substances.

and point out in the graphic formulas the atomicity and quantivalence of each element upon what type they are written.

Silver nitrate,
Lead nitrate,
Potassium sulphate,
Hydrogen sodium carbonate,

Calcium phosphate,
Ammonium iodide,
Hydrogen phosphide,
Sulphurous acid.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

RHETORIC.

ANNUAL EXAMINATION.

JUNE 15, 1875.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

1. Explain reasoning by analogy, the straining of a metaphor, turgidity, prolixity, explicit reference, obverse iteration, taste.

2. What conditions are necessary in order that figures should aid the understanding that they should heighten the feelings? that they should be a source of pleasure?

3. Distinguish between simile and metaphor.

"The coining of metaphors is a means of increasing the names in a language." Explain.

*3. Why does English give specially good opportunities for personification? Give the various forms of synecdoche.

4. Explain what is meant by plurality of knowledge, and show what connection has with antithesis. When is redundancy permissible?

*4. What is the object and what are the sources of brevity? "Words and expressions most nearly related in thought should be placed closest together." Why?

5. Name six cases in which conjunctions may be safely dispensed with in connecting sentences.

*5. Give the rules for the structure of the paragraph.

6. Give Blair's rules for unity.

7. "The more general a notion is the more difficult it is to conceive." Explain.

8. What conditions must be fulfilled in order that the description of imposing objects may be a source of strength or sublimity, in composition?

*8. Name some combinations of syllables that are opposed to melody. [Give if at least.]

9. Distinguish between a loose sentence and a period.

10. *Official report.*

Write an official report, giving an account of the survey of the harbor of San Juan del Norte by a party under your direction, describing the changes that have taken place since the last survey, and stating your opinion as to the probability that the port will eventually recover its commercial advantages.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SHIP-BUILDING.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—*Time allowed, four hours.*

WOODEN SHIP BUILDING.

1. Describe the keel, and explain the manner of scarfing the different lengths. How is the stem united to the keel? How is the stern-post secured to the keel? Where should the scarf of the keelson be placed?

2. Describe a frame: state fully the names of its different parts and siting them. What is the joint of a frame? What are filling-timbered?

3. Describe cant-frames and hawse-pieces: their object: how secured-book. State the use of chocks, where placed, how secured.

4. Give the names and positions of the different strakes of outside and inside plating. State fully the manner of securing a deck-beam to the ship's side.

5. Describe the manner of working bitts. Describe the kind of rudder to be used on a steamer having a stationary propeller.

6. Define the different docks used in this country, and describe manner of docking a vessel in the ordinary dry-dock.

7. Make all preparations for launching.

IRON SHIP BUILDING.

2. Describe the different kinds of keels used in the transverse system of framing and state the manner of forming the scarf in each case.

3. Describe the frame of an iron ship built on the transverse system, and show how the framing differs when the vertical keel is *intercostal* and when *continuous*.

10. Describe the different kinds of beams used and the modes of securing them to the ship's side.

NAVAL TACTICS.

ANNUAL EXAMINATION.

JUNE, 1875.—Time allowed, four hours.

I.

Draw a diagram of a fleet of twenty-four vessels in line, natural order. Show by means of brackets how it is divided into divisions and squadrons, placing the name of each over its bracket. Show by whom commanded, by placing the number denoting order of rank to the right of the name of division or squadron.

State positions of commander-in-chief, division, and squadron commanders. Draw a diagram of a fleet of twelve vessels in column, natural order.

Show as above how they are divided, named, and commanded. State the positions of commander-in-chief and division commanders. State the distance between vessels at half distance, in close order, and in open order.

II.

Draw diagrams of fleet in double echelon, in natural, in reverse, inverted, and reverse-inverted order. What is echelon in bow-and-quarter line, and how is it formed?

III.

The commander-in-chief signals, "Fleet wheel to NE.," the fleet being in line, heading north. Show how the front can be changed by another method, giving all the necessary signals to be made by the commander-in-chief. How do you make the command-signal N. $\frac{1}{4}$ W.?

IV.

The fleet being in column of vessels in natural order, heading north, form it into columns of vessels abreast by divisions, preserving the original direction.

V.

The fleet being in columns of vessels abreast by divisions in natural order, heading north, form it into column of vessels on the right division in natural order, and preserving the original direction.

VI.

The fleet being in columns of vessels abreast by divisions in natural order, heading north, change direction to NE.

VII.

The commander-in-chief signals: "From the vessel whose distinguishing pennant shown above this signal, form *double echelon*."

Supposing the distinguishing pennant of No. 13 to be shown, re-form the line front.

VIII.

The fleet being in column of vessels by the wind and headed off, restore the order the same tack. The wind veers aft, restore the order on the same tack.

SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, MAY, 1874.

I.

1. Reeve, cut, and fit the fore braces.
2. How do you cross a topsail yard?
3. How is a fish-davit rigged?
4. Cut, fit, and set up the main topmast backstays, wire-rope.
5. Set a mainsail, blowing fresh.
6. Ship running four points free, all drawing sail set, light weather, haul up hauled.
7. A $12\frac{1}{2}$ pts. ship, wind ESE. $\frac{1}{2}$ E.; how would the ship head on each tack respectively, if $1\frac{1}{2}$ pts. free?

II.

1. Reeve, cut, and fit the lower boom topping-lifts.
2. Make preparations for bending sails.
3. Rig and raise sheers.
4. Cut, fit, and set up the topmast rigging, wire-rope.
5. Take in a mainsail, blowing fresh.
6. Ship close-hauled on the starboard tack, keep away ten points; light weather, make sail.
7. A $12\frac{1}{2}$ pts. ship, wind WSW. $\frac{1}{2}$ W., ship $1\frac{1}{2}$ pts. free on the port tack; what compass-bearing of a light-house on the weather quarter?

III.

1. Reeve, cut, and fit the fore topsail braces.
2. Mizzen mast in, transport sheers and take in the main mast.
3. Rig purchase, and get over whole tops.
4. Cut, fit, and set up lower rigging, wire-rope.
5. Take in the topgallant sails, on a wind, fresh breeze.
6. Sails loosed to a bowline, furl them.
7. The wind blows from NW. by W. $\frac{1}{2}$ W. on the port quarter of a ship; how light bear per compass on the lee quarter?

IV.

1. Reeve, cut, and fit the lower boom topping-lift.
2. Make up a topmast studding-sail ready for setting.
3. Secure an anchor for sea.
4. Cut, fit, reeve, and set up the fore topgallant stay, wire-rope.
5. Take in the topgallant sails, before the wind, fresh breeze.
6. Make preparations for loosing sail and loose to a bowline.
7. A $12\frac{1}{2}$ pts. ship, wind WSW. $\frac{1}{2}$ W., ship $1\frac{1}{2}$ pts. free on the port tack; what compass-bearing of a light on the weather quarter?

V.

1. Reeve, cut, and fit the main braces.
2. Make up a lower studding-sail ready for setting.
3. Secure the lower yards for purchasing heavy weights.
4. Cut, fit, reeve, and set up the fore royal stay, wire-rope.
5. Set the main trysail in a fresh breeze.
6. Under royals, reduce sail to single-reefed topsails.
7. A $12\frac{1}{2}$ pts. ship, wind blows from SE. $\frac{1}{4}$ E., and the ship is $2\frac{1}{2}$ pts. free on the star-board tack; how does a light-house bear on the lee quarter?

VI.

1. Reeve, cut, and fit the spanker-boom topping-lift.
2. Lash, rig, and raise sheers.
3. Rig purchase, and get guns out through the ports.
4. Cut, fit, and set up the fore stays, wire-rope.
5. Set a jib in a fresh breeze.
6. Make sail to royals, giving all the orders, and state what is done at each command.
7. A $12\frac{1}{2}$ pt. ship heads SSW. $\frac{1}{4}$ W., $2\frac{1}{2}$ pts. free on the starboard tack; with the same wind, how would she head $2\frac{1}{2}$ pts. free on the port tack?

VII.

1. Reeve, cut, and fit the cross-jack braces.
2. Fit and bend a main trysail.
3. Get inboard sheer-legs, rig them, and raise them.
4. Cut, fit, reeve, and set up the jib-stay, wire-rope.
5. Take in a main try sail, fresh breeze.
6. Make preparations for bringing ship to anchor; call all hands and see officers and men at their stations.
7. A $12\frac{1}{2}$ pt. ship, wind blows from SE. $\frac{1}{4}$ E., and the ship is $2\frac{1}{2}$ pts. free on the star-board-tack; how does a light-house bear on the lee quarter?

VIII.

1. Reeve, cut, and fit the main topsail braces.
2. How do you rattle down lower rigging?
3. Explain the mode of measuring for rigging by draft.
4. Cut, fit, and set up the bowsprit shrouds, wire-rope.
5. Haul down a jib, fresh breeze.
6. Make preparations for sea; see officers and men at their stations.
7. A $12\frac{1}{2}$ pt. ship heads SE.; she is on the starboard tack $3\frac{1}{2}$ pts. free, and has a light-house on the lee quarter; what would be the relative bearing of that light from the ship, if with the same wind she were $3\frac{1}{2}$ pts. free on the port tack?

IX.

1. Reeve, cut, and fit the mizzen topsail braces.
2. Make up and bend a mizzen topsail.
3. Call all hands and get ready to heave up anchor.
4. Cut, fit, and set up the jib-guys, wire-rope.
5. Set a lower studding-sail.
6. Close-hauled; all plain sail set; keep away two points and make all sail.
7. A ship heading North has the wind on the starboard quarter, and a light-house on the lee quarter; what would be the relative bearing of the light if the ship were running with the same wind on the port quarter?

X.

1. Reeve, cut, and fit the fore topgallant braces.
2. Make up a jib for bending, and bend it.
3. Get a chain-cable on board, stow, bend, and bitt it.
4. Cut, fit, and set up the flying-jib martingale, wire-rope.
5. Take in a lower studding-sail.
6. Wind on the quarter, starboard studding-sails set; bring by the wind on the other tack.
7. The wind blows from SE. by E. $\frac{1}{2}$ E. on the starboard quarter of a ship, and the vessel comes out dead ahead; give the ship's head when close-hauled to the new wind on the starboard tack.

DEPARTMENT OF ORDNANCE AND GUNNERY.

INFANTRY-TACTICS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—*Time allowed, four hours.*

1. Give the four exercises for setting-up.
2. Give the formation of a company in line, and with ranks open, with the posts of commissioned and non-commissioned officers; and the distances between ranks making in quick time, double time, and over rough ground.
3. Give the principles of the wheel and the turn; the general rules in reference to the guide; and, being in line at a halt, describe the wheel to the left.
4. Give the three general rules to avoid repetition in the manual of arms. Describe the secure from the carry, the right-shoulder from the support, the unfixed bayonet fix the order, the load in four times, and the aim in the direct fire and to the right and left oblique.
5. Being in line at a halt, form single rank and re-form double rank; form column of fours and re-form column of fours.
6. Deploy a company as skirmishers by both flanks, change direction to the left to the centre, and open fire.
7. Give the formation of a regiment in line, with the posts of the commissioned and non-commissioned officers, and the general rules for successive formations.
8. A column of companies having partly changed direction to the right, form before all the companies enter the new direction and open fire by company and by platoon.
9. Being in line, form double column of fours and re-form the line.
10. Deploy a battalion as skirmishers by numbers, and rally on the battalion.

GUNNERY.

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, four hours.*

1. Sketch a blast-furnace. Letter and catalogue the parts.
2. Describe blowing-in; working the furnace; various blasts; their economy.
3. Give a table of fusibility.
4. Describe the composition of gray, white, and mottled cast irons. How do silica, manganese, sulphur, and phosphorus affect them?
5. Describe wrought iron. Sketch a puddling-furnace. What chemical reactions take place?
6. Describe briefly various kinds of steels, and the methods of producing them.
7. Describe various bronzes and alloys for guns. Give the constituents, strength, and peculiarities; also the circumstances affecting their production and casting.

9. What qualities are required in the metal for guns? Give a general comparison of cannon-metals. Which is the best? Why?
10. Define elasticity and ductility. Define, and illustrate by a diagram, the modulus elasticity and work done in producing rupture.
10. Describe tersely the details of manufacture of a 7-inch Fraser gun.

DEPARTMENT OF ASTRONOMY AND NAVIGATION. ASTRONOMY.

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, five hours.*

1. Define vertical circles, hour-circle, prime vertical, celestial latitude, celestial longitude, right ascension, declination, altitude, azimuth, amplitude, sidereal time, apparent time, mean time, hour-angle, sidereal year, tropical year, anomalistic year, geocentric and heliocentric parallax, conjunction, and the line of nodes of a planet's orbit.
2. Discuss fully the equation of time. What is its value, at any instant, in terms of the true sun's right ascension and longitude?
3. Explain how to find the heliocentric longitude of an inferior planet's node from observations made when the earth is not on the line of nodes of the planet, and when the planet's distance from the sun is not known.
4. How is the inclination of a planet's orbit to the plane of the ecliptic found? How are the right ascensions and declinations of stars determined? What gives rise to the difference in length between sidereal and solar days?
5. Name the different kinds of solar eclipses. Deduce, in terms of parallax and semi-diameter, an expression for the solar ecliptic limits, and show from it when an eclipse will take place. State upon which limb of the sun first contact takes place, and in what direction the shadow of the moon traverses the earth.
6. Show how to obtain the horizontal parallax of the moon, and thence its distance from the earth.
7. Deduce the formula for finding the geocentric parallax of a heavenly body. Give the method of finding the heliocentric longitude of a planet when the periodic times of the earth and planet are given as well as the planet's elongation and geocentric longitude.

DEPARTMENT OF PHYSICS AND CHEMISTRY. ELECTRICITY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—*Time allowed, four hours.*

1. Explain the laws of electrical induction, both statical and dynamical. Give the laws in the latter case.
2. Explain the induction of currents by magnets and the construction of one of the machines for developing a current by a magnet.
3. Explain the construction of the gravity-battery in which Zn. and Cu. are used. What are the chemical reactions which take place?
4. Define electro-motive force, strength of current, and resistance. Discuss Ohm's law,
$$E, S = \frac{E}{R}.$$
5. Describe the method of finding the intensity of the earth's magnetism at any point. Explain the inductive action of the earth on soft iron.

6. How is a compass-card constructed? how supported, and for what reason?
7. Describe the construction of a torpedo-fuse, to be used with frictional electricity. In what particulars should it differ from a fuse to be ignited by dynamical electricity and why?
8. Find equivalent of Siemen's unit of resistance in copper wire 2 millimetres diameter: conductivity of copper, 99.9; of mercury, 1.6.
9. How is a thermo-element constructed? How is the current produced? How does the E. M. F. of a thermo-element compare with the E. M. F. of a hydro-element?
10. Describe Wheatstone's bridge, and the manner of using it to measure resistance.
11. Wishing to explode a sub-marine mine, in which are two fuses in continuous circuit, each fuse having a resistance of one ohm at the firing-point, the resistance of the leading wires being 18 ohms, and strength of current necessary to fire a fuse being .75 webers; how many cells of the following dimensions must be employed, and how must they be arranged?

$$\text{1st case. } \begin{cases} \text{E. M. F.} = .6 \text{ volt.} \\ \text{Int. res.} = .4 \text{ ohm.} \end{cases}$$

$$\text{2d case. } \begin{cases} \text{E. M. F.} = 1 \text{ volt.} \\ \text{Int. res.} = 4 \text{ ohms.} \end{cases}$$

APPLIED MATHEMATICS.

SEMI-ANNUAL EXAMINATION.

JANUARY 25, 1875.—Time allowed, five hours.

MECHANICS.

Five solutions required.

1. Show that the algebraic sum of the moments of any number of forces, acting in one plane on a particle, taken about any point in their plane, is equal to the moment of their resultant about the same point.
2. A spanker-gaff a feet long (weight w) is hung by throat and peak halliards, whose directions make angles denoted by α and β respectively with the gaff; the centre of gravity of the gaff is b feet from the jaws; find the tensions on the halliards, and the thrust on the mast.
3. Find the distance of the centre of gravity of a hemispherical bowl from the base a being the internal radius and b the thickness. From this result find the position of the centre of gravity of a hemispherical surface.
4. The altitude of a right cone is h , and the diameter of its base b ; a string is fastened to the vertex and to a point in the circumference of the base, and is then put over a smooth peg. If the cone rests with its axis horizontal, what must be the length of the string?
5. A weight is supported upon a smooth plane, inclined at an angle α to the horizon by a force which is exactly equal to the pressure on the plane; find the direction of this force.
6. A uniform straight beam (length b) rests horizontally on a rough cylindrical barrel (radius a); required the greatest weight which can be suspended from one end of this beam without causing it to slip off, the coefficient of friction being μ .

DIFFERENTIAL CALCULUS.

Five solutions required.

1. Give the limits between which each of the inverse trigonometric functions is taken, and the reasons for thus restricting the values of these functions.

Derive the value of $d \left[\sec^{-1} \frac{mx}{a} \right]$ in terms of x , m , and a .

2. Trace the curve $y = \log_e x$, and prove that, if the point whose abscissa is e be joined to the origin, the joining line will be a tangent to the curve.

3. The crank of a small steam-engine is one foot long, and revolves uniformly at the rate of two turns per second, the connecting-rod being five feet in length; find the velocity of the piston when the crank makes an angle of 45° with the line of motion of the piston-rod; also, when it makes an angle of 135° , and an angle of 30° .

4. Expand $e^{\sin x}$ by Maclaurin's theorem (four terms).

5. Given $\log_e 7 = 1.9459102$ to find $\log_e 51$ to five decimal places.

6. Find the length of the shortest fence that will divide a given triangular field into two equal parts; the sides of the given field being a , b , and c .

7. Required, the number of parts into which a number a must be divided: in order that the continued product of the parts may be a maximum.

MECHANICS.

WEEKLY EXAMINATION.

APRIL 2, 1875.—Time allowed, two and one-fourth hours.

One question may be omitted.

1. Show that the intensity of the attractive force of the sun is the same for all the planets at the same distance from the sun.

Prove that—

$$\text{velocity} = \frac{\text{rate of area}}{\text{perpendicular on tangent}}$$

2. Find the velocity and periodic time in the case of a body revolving in a circle at a distance of 60 radii from the earth's centre.

3. Determine the orbit that a body will describe when acted upon by a force varying inversely as the square of the distance, assuming the equation

$$c^2 \left[\left(\frac{du}{d\omega} \right)^2 + u^2 \right] - 2 \int \frac{du}{u^2} = c'.$$

4. Deduce a general expression for the velocity of a planet at any point of its orbit. Show how Kepler's third law may be deduced from his first and second laws.

5. Assuming that the force of attraction of the sun on a planet varies inversely as the square of the distance of the planet from the sun, deduce Kepler's third law.

6. Find the least initial velocity which will enable a body projected from the earth to reach the moon, the radius of the moon being three-elevenths that of the earth, and the distance between the centres sixty times the earth's radius.

APPLIED MATHEMATICS.

ANNUAL EXAMINATION.

JUNE 17, 1874.—Time allowed, five hours.

Ten solutions required.

1. Find the entire length of the curve—

$$\left(\frac{x}{a} \right)^{\frac{2}{3}} + \left(\frac{y}{a} \right)^{\frac{2}{3}} = 1.$$

2. Find the volume of a life-preserver in the form of a ring generated by the revolution of an ellipse about an axis parallel to its minor axis: the outside radius being 18 inches, the inside radius 12 inches, and the thickness of the ring 4 inches. Deduce the general formula employed.

3. Find the displacement of the fore-body of a ship constructed on the "wave-line" principle, the midship-section being a semi-ellipse and the stem vertical; length of fore-body 100', half-breadth 20', and draught of water 15'.

4. At 8 o'clock p. m., a ship is 65 miles N.E. of a certain point; she is required to be 5 miles from this point at daylight (4 o'clock a. m.). It being known that there is a

current running E. of 2 miles per hour, on what course, and at what speed, should ship steam?

5. The resistance of the air to the motion of a projectile being proportional to the cube of its velocity, find general integral expressions for the co-ordinates of any part of its path.

6. Deduce the formula for determining differences of altitude by means of a barometer.

7. How many men weighing 150 pounds each will a balsa weighing 225 pounds having a volume of 30 cubic feet support, the specific gravity of a man being 1.1?

8. The horizontal axis of a circular sluice-gate 4 feet in diameter is 4 inches below the centre of the gate. How high will the water rise above the centre before it will open the gate?

9. Find the amount of water that will flow in five minutes through a rectangular hole in a ship's side caused by the removal of an iron plate 2 feet long and 15 inches wide (the longer edge being parallel to the water-line, and the upper edge 5 feet below it). Deduce the formula employed.

10. A rifle-shot is in the form of a cylinder two calibres in length surmounted by a hemispherical one and a half calibres in height. If it is discharged with a velocity of 1200 feet per second, and makes one turn in 40 feet, compare the work of rotation with that of translation.

11. If the work of driving a steamer through the water be proportional to the cube of her speed, find the cheapest rate of steaming against a current of a knots per hour.

12. A ship by ramming another reduces her speed from v feet per second to v' feet per second; the height of the centre of gravity of each of her broadside-guns is a feet above the deck being a , and the distance between their trucks b , find the relation which must exist between a , b , u , and v in order that the guns may not capsize.

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, JUNE, 1875.

I.

1. Reeve the gear of the lower studding-sail.
2. Fit and set up the fore topmast stay, wire-rope.
3. How does a ship carry her helm when trimmed by the head?
4. Set a mainsail, blowing fresh.
5. Ship riding head to wind and tide, get under way and cast to port.
6. By the wind, weather main topsail brace parts; what is to be done?
7. Sailing-vessels meeting, one with wind three points on the starboard quarter, the other with the wind two points on the starboard quarter; which has the right of way?

II.

1. Reeve the cat-fall and cat an anchor.
2. Fit and set up the fore-stay, wire-rope.
3. How does a ship carry her helm when trimmed by the stern?
4. Take in a mainsail, blowing fresh.
5. Ship is riding head to wind; get under way and stand out before the wind.
6. Wind on the starboard quarter; weather main topsail brace parts; what is to be done?
7. Steamers meeting, one steering north, the other southwest; which has the right of way?

III.

1. Reeve the gear of the main topsail.
2. Fit and set up the main topmast stay, wire-rope.
3. What kind of a helm ought a ship to carry on a wind?
4. Set a close-reefed topsail.
5. Scudding, with the wind on the starboard quarter, the ship broaches to; what is to be done?
6. Before the wind, the mizzen topgallant parrel carries away; what is to be done?
7. Steamers meeting, one steering south, the other south by east; which has the right of way?

IV.

1. Reeve the gear of the spanker.
2. Fit and set up the mizzen stay, wire-rope.
3. Should your ship, on a wind, carry too much weather helm, how would you remedy it.
4. Take in a close-reefed topsail.
5. Moderate breeze, wind on the starboard quarter, all drawing sails set, a man falls overboard; what is to be done?
6. What is to be done when, in hauling down the jib, the down-haul parts?
7. Sailing-vessels meeting, one steering east-northeast, the other west, the wind being north; which has the right of way?

V.

1. Reeve the gear of the main sail.
2. Fit, reeve, and set up the flying-jib stay, wire-rope.
3. Should your ship, on a wind, carry much lee helm, how would you remedy it?
4. Take in topgallant sails, on a wind, blowing fresh.
5. By the wind, under all plain sail, a man falls overboard; what is to be done?
6. Weather sheet and clewline of main topsail carried away; what is to be done?
7. Sailing-vessels meeting, wind south, one steering east-southeast, the other west; which has the right of way?

VI.

1. Reeve the main brace.
2. Fit, reeve, and set up the jib-stay, wire-rope.
3. What are the terms used in conning ship?
4. Take in the topgallant sails before the wind, blowing fresh.
5. By the wind, under all plain sail, you are struck by a squall; what do you do?
6. Parrel of main topsail yard carried away; what is to be done?
7. Steamers meeting, one steering south, the other northeast; which has the right of way?

VII.

1. Reeve the cross-jack and mizzen topsail braces.
2. Cut, fit, and set up lower rigging, wire-rope.
3. Set a main trysail, blowing fresh.
4. Trim yards close-hauled; moderate weather.
5. Riding to ebb-tide by starboard anchor, wind on the starboard beam; get under way and stand out on the port tack.
6. By the wind, main spring-stay parts; what is to be done?
7. Sailing-vessels meeting, wind north, one heading west-northwest, the other east-northeast; which has the right of way?

VIII.

1. Reeve the mizzen topgallant and royal braces.
2. Cut, fit, and set up topmast rigging, wire-rope.
3. How do you trim yards close-hauled, fresh breeze? Why?
4. Set a jib, blowing fresh.
5. Riding to tide, wind aft, get under way from the starboard anchor and stand out on the port tack.

6. Cross topgallant and royal yards, and bend the gear.
7. Sailing-vessels meeting, wind south, one heading west, the other east; which the right of way?

IX.

1. Reeve the fore topsail brace.
2. Cut, fit, and set up the topgallant rigging, wire-rope.
3. In loosing sails, which gaskets are cast off first? Why?
4. Take in a jib, blowing fresh.
5. Riding to the tide by the port anchor, wind aft, get under way and stand before the wind.
6. Send down the topgallant and royal yards.
7. Steamers meeting, head on; what is the rule of the road to avoid collision?

X.

1. Hook on and hoist a quarter-boat in a sea-way.
2. Cut, fit, and set up the topgallant backstays, wire-rope.
3. How do you get the main tack close down?
4. Set a lower studding-sail.
5. Riding head to tide, wind two points on the starboard bow, get under way stand out on the port tack.
6. Send down the topgallant masts at sea.
7. What lights are carried by steamers and what by sailing-vessels at sea? What lights are carried by vessels at anchor? Being officer of the deck at night, you see a red light two points on the starboard bow; what does this indicate?

NAVAL ARCHITECTURE.

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, five hours.*

1. Name and describe the principal qualities sought in a ship. On what principle does buoyancy depend? What is the centre of gravity of a vessel? What is the centre of buoyancy?
2. What is stability, and how does an excess of it affect a vessel? How is easy rolling insured in a vessel? Explain the difference between stiffness and steadiness of a vessel.
3. What is the trapezoidal rule? What are Simpson's first and second rules? Write out the formula for Simpson's second rule.
4. Give the rule for finding how far a given single weight must be shifted in order to shift the common centre of gravity through a given distance in the same direction. What are the plans from which measurements are taken to find the displacement and stability of a vessel, and what measurements are obtained of each?
5. How is the displacement of a vessel computed? How is the centre of buoyancy determined? What is the coefficient of fineness, and what is its use in designing a vessel? Describe the curve of displacement.
6. Deduce formulas for determining the centre of gravity of a vessel equipped for sea, and explain a practical method of making the calculations. What is the centre of a vessel?
7. Explain fully what measurements are required, and the method of computing registered tonnage according to the United States tonnage-laws. How do you determine the centre of effort of the sails of a ship?
8. On what does the limit of safety of ships as regards capsizing depend? Illustrate the curve of stability and discuss it.
9. Name and explain fully the different lines used in designing a ship. How do you find the augmented surface of a ship and compute the probable speed?
10. State the principles of the wave-line theory, and show the advantage of constructing a ship upon it. Given the length of entrance and run, construct the most favorable to speed,

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE AND ARMOR.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—*Time allowed, four hours.*

1. Describe fully all gun-metals; discuss their relative values.
2. Discuss laminated and solid armor with reference to racking and punching.
3. Define the systems of rifling; give types, merits, and defects of each.
4. State the objects of rifling; causes of drift, long range, high initial velocity, best form of projectile for range and for penetration under different conditions.
5. Explain the strains due to rifling; examples. What is the best form of groove?
6. Describe fully manufacture, rifling, projectiles, &c., of 100-pounder Parrott rifle.
7. Explain the manufacture, give theory of construction, and discuss the merits of the Vavasseur gun.
8. Explain the manufacture, theory of construction, and discuss the merits of the Woolwich (Fraser) gun. Set a breech-sight to counteract drift.
9. Describe the manufacture of the Krupp gun; give the peculiarities of rifling, projectiles, and breech-closing apparatus.
10. Give the theory and construction of the Parsons proposed converted XI-inch rifle. Describe the Reffye projectile and breech-closing apparatus; Whitworth projectiles and breech-closing apparatus.

DEPARTMENT OF STEAM-ENGINEERY.

MARINE-ENGINES.

ANNUAL EXAMINATION.

JUNE 15, 1875.—*Time allowed, four hours.*

I.

Sketch an indicator-diagram from a condensing-engine. Describe its main features, and explain its uses.

II.

What disadvantage that is not incurred in inland waters, attends the use of steam-engines at sea? Describe the means employed to countervail this disadvantage.

III.

Describe any apparatus that you know of, by which the admission of steam to the cylinder is suppressed before the stroke of the piston is completed, and explain why such suppression is desirable.

IV.

Describe the compound engine.

V.

Compute the indicated horse-power of a steam-engine from the following data, viz: mean unbalanced pressure upon piston, 50 pounds; back-pressure, 5 pounds; diameter of piston, 60 inches; stroke of piston, 36 inches; double strokes of engine per minute, 70; measure of expansion, 2; log $e = .693$. Give the absolute terminal pressure.

VI.

Estimate the quantity of water that will be required for effecting condensation in the case of Question V, the temperature of the feed being 120° F., of the sea 60° F., of the steam discharged from the cylinder 254° F., the latent heat 935 units, and the weight of one cubic foot of the steam at terminal pressure .0315 pound.

VII.

In the case of Question V, what per centum of the whole quantity of coal used have been saved had the engine been employed on Lake Erie instead of at sea?

concentration at sea, $\frac{12}{32}$; at Lake Erie, $\frac{0}{32}$.

VIII.

Sketch and describe two kinds of apparatus for indication of pressure in boiler condensers, explaining their several modes and principles of action.

IX.

The maximum speed of a steamer being 12 knots when consuming 60 tons coals per diem, compute the speed and the daily consumption of fuel with which she may run 2880 miles with most dispatch, consuming 500 tons of coal.

X.

In the case of Question IX, the maximum number of revolutions of the vessel's screw being 70 per minute, compute the slip of the screw in per centums of its speed.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, five hours.*

THEORY OF NAVIGATION.

1. Deduce the formulas for computing the great-circle course and distance between two places on the earth's surface, given by their latitudes and longitudes; and, the formulas for computing the latitude and longitude of this great circle's vertex.

2. Deduce the formulas for computing the latitude at sea from an observed altitude of a heavenly body off the meridian, when you have given the Greenwich chronometer-time, the longitude by observation, and the latitude by dead reckoning.

What two advantages does this method possess over the versin method given in Bowditch's Navigator?

With the above data, when does this method fail at sea?

3. State the optical principle of the construction of a sextant. Explain how to use just a sextant, using in the operation the sea-horizon.

4. Deduce the formula for computing by the sine the hour-angle of a heavenly body, and the formula for finding by the cosine the azimuth of a heavenly body, when you have given for both the altitude of the body and the Greenwich chronometer-time, as well as the latitude and longitude of the observer.

When the latitude at sea is uncertain, when should the observation for longitude be made; and what, at that time, would be the effect of a small error in the Greenwich chronometer-time and in the altitude?

5. Explain how, in a given port, you would rate the chronometer of a ship to Greenwich mean time:

- 1st, by single altitudes of the sun;
- 2d, by double altitudes of the sun;
- 3d, by equal altitudes of the sun.

State concisely all that a careful navigator should do in each of the above cases to obtain the best possible rating.

6. Deduce all the formulas necessary for computing, at a given place, the astro-

cal bearing of a distant light-house when the angle between the sun's nearest limb and the light-house is measured with a sextant, and the local mean time noted; and, also, the altitude of the light-house above the sea-horizon is measured with a sextant.

PRACTICAL WORK IN NAVIGATION.

JUNE, 1875.—*Time allowed, nine hours.*

1. June 18, 1875. At Boston Light, Massachusetts, in longitude $4^{\text{h}} 43^{\text{m}} 32^{\text{s}}$ W. Required the time of the p. m. high water, the corrected establishment being $11^{\text{h}} 12^{\text{m}}$. Which will be the higher, this or the a. m. tide of the same civil day?

2. December 9, 1875. Being at sea, in latitude $41^{\circ} 30'$ N. by dead reckoning, and in longitude $4^{\text{h}} 30^{\text{m}} 43^{\text{s}}$ W., as brought forward from the morning *time-sight* of the sun, observed with a sextant the altitude of the sun's lower limb, $23^{\circ} 16' 20''$; index-correction of sextant $+ 2' 20''$; height of eye above the sea, 18 feet; watch-time of observation, $10^{\text{h}} 29^{\text{m}} 33^{\text{s}}$ a. m.; chronometer — watch, $4^{\text{h}} 18^{\text{m}} 13^{\text{s}}$; and the chronometer-correction on Greenwich mean-time $+ 22^{\text{m}} 29^{\text{s}}$; the latitude is required.

3. July 30, 1875. On shore, at a place in latitude $11^{\circ} 12' 16''$ S., and in longitude $11^{\text{h}} 25^{\text{m}} 15^{\text{s}}$ W. of Greenwich, I observed equal altitudes of the sun east and west of the meridian, with a sextant and artificial horizon, as follows:

A. M. watch-times of observation:

$8^{\text{h}} 21^{\text{m}} 01^{\text{s}}.5$
 $8 \quad 21 \quad 29.0$
 $8 \quad 21 \quad 58.0$

P. M. watch-times of observation:

$3^{\text{h}} 40^{\text{m}} 39^{\text{s}}.5$
 $3 \quad 41 \quad 08.5$
 $3 \quad 41 \quad 38.5$

Twice the altitudes of the sun's lower limb observed:

$43^{\circ} 20'$
 $43 \quad 30$
 $43 \quad 40$

Before the a. m. observation, compared the chronometer and watch as follows:

Chro., $7^{\text{h}} 11^{\text{m}} 33^{\text{s}}.5$
 Watch, $7^{\text{h}} 52^{\text{m}} 59^{\text{s}}.0$

And after the p. m. observations, compared again as follows:

Chro., $3^{\text{h}} 53^{\text{m}} 32^{\text{s}}.5$
 Watch, $4^{\text{h}} 32^{\text{m}} 11^{\text{s}}.0$

At each set of observations, the barometer was 30.10 inches, and the thermometer 70° , and the index-correction of the sextant $+ 2' 10''$. Required the error of the chronometer on Greenwich mean time.

4. June 13, 1875. At Annapolis, Md., in latitude $38^{\circ} 59'$ N., and in longitude $5^{\text{h}} 5^{\text{m}} 7^{\text{s}}$ W., swung ship for the local deviation of her standard compass, as follows:

Times of observation.		Ship's head by standard compass.	Simultaneous bearings—	
On board.	On shore.		Of a theodolite on shore by standard compass.	Of the standard compass by the theodolite.
<i>h. m.</i>	<i>h. m.</i>			<i>° /</i>
9 30	9 30	NNE.	N. 50° W.	110 30
9 36	9 36	ENE.	N. 55° W.	108 00
9 40	9 40	ESE.	N. 57° W.	105 00
9 50	9 50	SSE.	N. 61° W.	103 30
10 2	10 2	SSW.	N. 63° W.	102 00
10 7	10 7	WSW.	N. 59° W.	104 00
10 14	10 14	WNW.	N. 54° W.	106 00
10 25	10 25	NNW.	N. 50° W.	108 00

The theodolite read, when pointing along the zero-line, 100° . Required the local deviation of the standard compass for the ship's head on the given points. If the variation, by chart, was 9° westerly, what course, in degrees and minutes, must be steered by this standard compass to make a true course of NNE.; also of ENE.†

5. June 13, 1875, a. m. Latitude $34^{\circ} 16' 10''$ N.; longitude $8^{\text{h}} 39^{\text{m}} 44^{\text{s}}$ E. Required the local apparent time when the star α Arietis is in the eastern horizon, and its amplitude when rising.

6. June 20, 1875, a. m. Longitude $7^{\text{h}} 52^{\text{m}} 46^{\text{s}}$ E. Observed with a sextant the meridian altitude of the moon's upper limb $35^{\circ} 18' 30''$, bearing South; eye 18 feet above the water, and index-correction of the sextant $+2' 20''$. Required the latitude.

7. February 5, 1875. Latitude $10^{\circ} 20' 30''$ S.; longitude West. In the morning twilight, observed with a sextant the altitude of Venus, $23^{\circ} 15' 20''$; watch-time of observation, $4^{\text{h}} 48^{\text{m}} 09^{\text{s}}.5$ a. m.; chronometer—the watch, $2^{\text{h}} 39^{\text{m}} 17^{\text{s}}$; chronometer-correction on Greenwich mean time, $-23^{\text{m}} 03^{\text{s}}.5$; index-correction of sextant, $+2' 20''$, and eye 18 feet above the water. Required the longitude.

8. December 13, 1875. Latitude $34^{\circ} 22' 11''$ S.; longitude $1^{\text{h}} 14^{\text{m}} 1^{\text{s}}$ E. Observed with a sextant the angular distance of the sun's nearest limb from the vertical edge of a light-house in the true horizon, and to the right of the sun $43^{\circ} 31' 20''$; the index-correction of the sextant being $+2' 20''$. The watch-time of the observation was $7^{\text{h}} 1^{\text{m}} 31^{\text{s}}.5$ a. m.; the chronometer minus the watch, $10^{\text{h}} 54^{\text{m}} 17^{\text{s}}.5$; and the chronometer-correction on Greenwich mean time $-11^{\text{m}} 32^{\text{s}}.5$.

Required the true altitude and azimuth of the sun, and the true azimuth of the light-house. If the variation was 5° easterly, what was the correct magnetic bearing of the light-house†

9. April 15, 1875. At noon took departure from a light-house in latitude $49^{\circ} 55' \text{N.}$; longitude $5^{\circ} 15' \text{W.}$, bearing per compass NNE. and 10 miles distant; the ship's head being N. and the local deviation on that heading $\frac{1}{2}$ point westerly. Variation by chart $1\frac{1}{2}$ points westerly. Thence sailed:—

20 knots 0 fms. S W. by W.	Wind, Sd. and Ed.	Lee-way, $1\frac{1}{2}$ pts.	Deviation, $\frac{1}{2}$ pt. W.
22 knots 0 fms. SSW.	Wind, Sd. and Ed.	Lee-way, $1\frac{1}{2}$ pts.	Deviation, $\frac{1}{2}$ pt. W.
15 knots 4 fms. WSW.	Wind, Nd.	Lee-way, $1\frac{1}{2}$ pts.	Deviation, 0.
10 knots 0 fms. W. by S.	Wind, Nd.	Lee-way, $1\frac{1}{2}$ pts.	Deviation, $\frac{1}{2}$ pt. E.
*8 knots 4 fms. W.	Wind, Nd.	Lee-way, $1\frac{1}{2}$ pts.	Deviation, $\frac{1}{2}$ pt. E.

Required the latitude and longitude and the course and distance made good from the light-house to this position by dead reckoning.

10. On April 16, 1875, observed, with a sextant, the meridian altitude of the sun's lower limb, $52^{\circ} 15' 10''$, bearing South; the eye being 18 feet above the water, and the index-correction of the sextant $+2' 20''$. Required the latitude.

On April 16, 1875, about 9 a. m., observed with a sextant the altitude of the sun's lower limb, $37^{\circ} 40' 00''$. The watch-time of the observation was $8^{\text{h}} 45^{\text{m}}$; the chronometer minus the watch, $30^{\text{m}} 30^{\text{s}}$; and the chronometer-correction on Greenwich mean time, $+10^{\text{m}} 20^{\text{s}}$; the eye was 18 feet above the water, and the index-correction of the sextant $+2' 20''$.

At the same time, the sun's bearing, per standard compass, was S. 36° E., the ship's head being North. Variation from chart 17° westerly.

Required the longitude at noon, and the local observed deviation of the standard compass, for the ship's head at North. Required, also, the direction and rate per hour of the current.

* Run to noon, April 16, from a. m. time-eight.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

SOUND AND LIGHT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—*Time allowed, five hours.*

1. Upon what does the intensity of sound depend? Explain the causes which influence the intensity of sound.
2. Explain the undulatory theory of light, and give some of the facts that decided in favor of this theory.
3. Explain the phenomenon of single refraction according to the undulatory theory.
4. Explain the manner in which a concave mirror forms an image. A lighted candle is placed in front of a spherical mirror, the candle being perpendicular to the axis and in the same plane with it; find how the image moves as the candle burns.
5. Deduce and discuss the formulas for spherical mirrors. The flame of a candle 2'' in height is placed in front of a concave mirror of 3' radius, at a distance of 10'; find the position and magnitude of the image.
6. What is meant by the critical angle of a substance? Show under what conditions a ray of light which has been refracted at one face of a prism will emerge at the second face.
7. Explain the cause of the dark lines of the solar spectrum. What proof have we of the cause of these lines? Under what conditions are these lines visible?
8. Explain the construction of the refracting astronomical telescope. The focal length of the object-glass of a telescope is 40'.53, and of the eye-piece 0''.52; what is the magnifying power of the telescope?
9. Explain the phenomenon of diffraction produced by parallel rulings on glass.
10. What do you understand by plane polarization of light? How is a ray polarized? How do you determine whether light is polarized?
11. Find the magnifying power of an astronomical telescope whose object-lens has a focal length of 10'.27, and eye-piece a focal length of 0''.5, for a person whose distance of distinct vision is 15''.

HEAT.

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, four hours.*

1. Change into centigrade the following temperatures Fahrenheit:—	
Melting-point of mercury	—40°
Melting-point of wax	158°
Melting-point of tin	442°
Intense white heat	9732°

How many degrees Fahrenheit in n° centigrade?

2. The French unit of heat is the quantity of heat required to raise the temperature of one kilogramme of water from 0° C. to 1° C.; the English unit is the quantity of heat required to raise the temperature of one pound avoirdupois of water from 32° F. to 40° F. What is the relation between the two units? (One kilogramme = 2.2046 pounds.)
3. What relation exists between the linear and cubical coefficients of expansion of a solid?
A bar of metal is 5.875 metres long at 10° C., and 5.888 metres long at 75° C.; what is the coefficient of expansion of the metal?
4. Explain the nature of the correction to be applied to the barometric height for temperature. Deduce the form of the correction for any case where H is the height at t° C., h the height at 0° C., and d and d' the densities of mercury at these two temperatures, respectively. What are the reduced heights of the barometer observed as follows?—

770 millimetres at —20° C.

730 millimetres at —10° C.

5. State the laws of fusion as determined by experiment. What is latent heat of fusion?

6. To determine the latent heat of fusion of lead, 200 grammes of melted lead (temperature 335° C.) was poured into 1850 grammes of water at 10° C. After the lead had cooled, the temperature of the water was found to be $20^{\circ}.76$ C. Required latent heat of fusion of lead, the specific heat of lead being 0.00314.

7. Explain the construction and use of Regnault's hygrometer.

8. Calculate the weight P of a volume V of moist air whose hygrometric state is E , and temperature t ; height of barometer H ; the density of aqueous vapor being $\frac{1}{8}$ that of dry air.

9. What influence does the moisture in the atmosphere have upon the temperature of the earth? Give explanation.

10. Define specific heat, and explain how the specific heat of a solid or liquid is determined by the method of mixtures. All corrections required.

11. A shell weighing 350 pounds upon striking the side of a ship has its velocity diminished from 1500 to 500 feet per second. How much heat will be developed by the blow? To what temperature would the shell be raised if it receives one-half the heat, specific heat of iron being 0.12983?

12. Explain specific heat under constant pressure and specific heat under constant volume.

13. Knowing the specific heat of air under constant pressure and under constant volume, how may the mechanical equivalent of heat be calculated? A cubic foot of air at 0° weighs 1.29 ounces, and the specific heat of air under constant pressure is 0.24 as compared with an equal weight of water.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.

ANNUAL EXAMINATION.

JUNE 11, 1875.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

CONSTITUTION OF THE UNITED STATES.

1. Describe the process of amendment.

2. With whom rests the power of impeachment? the power of trying impeachments? of choosing Senators? of compelling the attendance of members of either House, in default of a quorum? of appointing Judges? of defining the punishment of treason? of making treaties of peace? of declaring war?

INTERNATIONAL LAW.

3. Define International Law, and show upon what basis it rests.

With what writer, and at what time, did the modern system of International Law begin?

*3. Explain any two of the following: municipal law, civil law, common law, statute law, constitutional law.

When are foreign powers justified in recognizing the independence of a revolted state?

4. State the rule of law as to the confiscation of government bonds held by the enemy, and give the reason for it.

What was the policy of the United States during the civil war, in regard to confiscation of enemy's property and debts?

*4. Define domicile. What is the test of domicile?

What is the effect of a foreign domicile at time of war? [Two cases: 1. Neutral domiciled in a belligerent country. 2. Subject of belligerent government domiciled in a neutral country.]

*5. Explain what is meant by the recognition of belligerency in the case of a rebellion, and show how it affects the relations of the government: (1) with the party in revolt, (2) with other governments.

Apply this in the cases of the English and Virginians.

*6. Explain the difference between contrabands and non-contrabands.

Explain the treatment of non-contrabands by hostile forces on land and at sea.

Explain the position taken by the leading states of Europe at the Brussels conference of 1874, in regard to treatment of non-contrabands.

*7. Explain fully any three of the following:—

1. Bottomry-bonds.
2. Registry, enrolment, and licence.
3. General average.
4. Bill of lading.
5. Contraband.

*8. State in full the distinction drawn as to ships and cargo in asphyxiating upon a neutral the penalty for—

1. Breach of blockade.
2. Carrying contraband.
3. Carrying enemy's dispatches.

*9. Define preliminary, and state the limitations of the law as to: 1. time [in England and in the United States]; 2. place; 3. property [real, personal, moveables]; (4) persons.

*10. State the provisions of the Declaration of the Congress of Paris in 1864. What objection was urged by the United States to the first of these principles? (that relating to privateering). How was the objection met in the war of 1861?

*11. In case of a violation of neutrality by one belligerent, from whom do the injured parties seek reparation?

Illustrate in the case of the Florida.

*12. War between the United States and Spain: in command of the U. S. Steamer Dictator, cruising in the West Indies, you fall in with a fleet of French merchant-vessels, under convoy of a French man-of-war: the commander of the latter declares on his word of honor that there is no breach of neutrality connected with the voyage, and requests you to waive the right of search. He states his intention of making a forcible resistance if his request is not complied with. [N. B.—No treaty with France on this subject.]

Later, you capture a bark owned in Rio, and engaged in carrying contraband to Havana. She is taken into port and condemned on that ground. It appears that she was originally an American vessel, but captured early in the war by the Spanish, condemned as enemy's property, and sold to the firm in Rio. The original owner puts in a claim. How is it to be decided?

*13. Some time after, you speak and search two vessels, both American, and trading between New York and Havana, one a brig under a license from the Spanish government, the other a bark under a license from the Department of State of the United States. What would you do?

Later, you find a third vessel, a neutral, licensed like the last, bound for Havana from Halifax, having on board cavalry saddles and uniforms, which the owner of the ship is sending as a part of the cargo, along with other merchandise belonging to himself and other parties. Consequences?

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF STEAM-ENGINEERY.

STEAM-ENGINEERY.

ANNUAL EXAMINATION.

JUNE 1875.—*Time allowed, four hours.*

[* Starred questions may be substituted for any others excepting VI and VII.]

I.

Define displacement-tonnage and burden-tonnage. State how they compare in naval steamers, and in which of them the weights of machinery and fuel are included.

II.

According to the wave-line theory, what should be the lengths of the fore and the after bodies of a vessel for a speed of 18 knots an hour? What is the nature of the curves, and how are they constructed?

III.

Define the terms wetted surface and augmented surface. Calculate the quantities from the following data:

Mean squares of sines of greatest obliquity.....	.0252
Mean of the fourth powers of the same	.0008
Length of load-water line.....	304 feet—
Length of mean immersed girth.....	40 feet—

IV.

Calculate the I. H. P. for a vessel whose augmented surface is that of Question III, for a speed of 18 knots an hour. Datum: co-efficient of propulsion, 20,000.

V.

Find the diameter of the cylinders of a pair of condensing non-compound engines of 4000 I. H. P. of 4 feet stroke of piston, with total clearance of $6\frac{1}{2}\%$ of the space-displacement per stroke; the revolutions, 55 per minute; boiler-pressure, 50.36 pounds per square inch, by gauge; cut-off at 31 inches from beginning of stroke; compression at 5 inches before end of stroke; vacuum, 24 inches; barometer, 30 inches. Give also the width of the steam-ports of the cylinders, their length being 51 inches.

VI.

In the case of Question V, it is desired to cut off the steam at $\frac{2}{3}$ the stroke from the beginning, the steam-opening to commence when the piston is $\frac{1}{2}$ inch from beginning of stroke; exhaust-closure to take place when the piston is 5 inches from the end of stroke. Give the steam and exhaust lap; the travel of valve; the steam and the exhaust lead opening, when the crank is at the dead-points. Give all results in inches.

VII.

In the case of Questions V and VI, a Mayer's expansion-valve is to be applied, to cut off from $\frac{1}{2}$ to $\frac{2}{3}$ the stroke. At *least* rate of expansion, the blocks to be together; and at *greatest* rate of expansion, $10\frac{1}{2}$ inches apart. The greatest distance between

of main and cut-off valves, in the direction of and during their respective strokes, to be $4\frac{1}{2}$ inches. Give the least width of each expansion-block, and the the expansion-valve in inches, and show, by the Zeuner diagram, its position in angular advance.

VIII.

the area of feathering paddles for a vessel having 13,000 square feet augmented coefficient of friction, .0036; slip of wheel, 20 % of speed of ship; paddles in still water.

the diameter of a screw for the same vessel; circumference to be double the diameter of the hub one-fourth that of the screw; apparent slip 20 % of speed 1; working in water that moves with the vessel at one-tenth of the vessel's

IX.

the thickness of a cylindrical boiler-shell 10 feet in diameter, double-riveted, engines of Question V, the factor of safety being 6.

also the grate-surface, the heating-surface, and the calorimeter, in square feet number of the boilers.

X.

the condensing-surface of the engines of Question V in square feet, the diameter of the circulating (double-acting) pump, the stroke being that of the steam-piston temperature injection, 85° ; discharge, 115° ; exhaust steam, 215° ; hot well, 125° .

*XI.

and describe the leading features of four types of screw-propellers in common use.

XII.

and explain an ejector-condenser.

ANNUAL EXAMINATION.

JUNE 12, 1875.—Time allowed, five hours.

I.

what thermometric scale may the laws of the phenomena which depend upon temperature be most simply expressed? State what fixed point, other than the standards of ordinary scales, pertains to it. Give formula and explain notation.

II.

the weight of air, in pounds, that will be required for the combustion of 1000 of coal, composed of C, 0.87; H, 0.05; and O, 0.04. Give the per centum of fuel in an engine each horse-power of which costs two pounds of this coal.

III.

density of the water off Point Lookout being $\frac{1}{32}$ and the concentration of the water

in a launch boiler $\frac{11}{32}$, what per centum of the whole quantity of water pumped

boiler should be withdrawn to preserve this ratio of densities? Give the loss in per centum of the fuel utilized. Data: Feed-water, 70° F.; steam, 311° ; heat, 89° .

IV.

the case of Question III, heat in the water blown out should be imparted to the boiler, raising its temperature to 100° F., how much would the loss by blowing out be?

V.

A wrought-iron tube has a length of 8 feet, external diameter of 3 inches, thick of metal $\frac{1}{8}$ inch. Give the ratio that will exist between the resistances it will offer to collapsing and to bursting, the tensile strength being 50,000 pounds per square inch.

VI.

Calculate the diameter of a shaft for a pair of condensing-engines 60 inches diameter and 48 inches stroke of piston; cranks set at 90° , and the maximum steam-pressure gauge 50 pounds per square inch.

VII.

Discuss the comparative merits of long and of short stroke engines, and explain why the latter are commonly employed in naval screw-steamers.

VIII.

Describe the two common types of compound engines, pointing out in what action is different from that of common non-compound engines.

IX.

Sketch diagrams illustrating the action of steam in compound engines of two cylinders, working upon the same crank-shaft, but through separate cranks; and with two receivers.

X.

A vessel can steam 8 knots an hour on 20 tons of coal a day; what is the greatest speed at which she can make a passage of 2,500 miles, under steam alone, with 20 tons of coal? Give also the consumption of coal per diem.

DEPARTMENT OF PHYSICS AND CHEMISTRY. CHEMISTRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1875.—*Time allowed, five hours.*

1. State the three laws which define the molecular condition of a gas.
2. Write the various reactions by which carbon dioxide is formed. How many litres of it at $15^\circ.5$ C. and 74 cubic metres will be obtained from 500 grammes of sodium carbonate? Give the calculation in full, and explain each step. What are the characteristics of this gas?
3. Under what conditions does the energy of combustion take the form of light or of mechanical force? Illustrate by lime-light and by gunpowder.
4. What is meant by the valence of an atom? Give the formulas of four simple compounds which indicate the valence of the atoms of chlorine, oxygen, nitrogen, carbon, respectively, and state what means we have for verifying the formulas given.
5. Butyric acid and acetic ether have the same percentage composition and the same vapor density; how does the chemist explain the difference in their properties? What do you call such bodies?
6. Define the terms alcohol, glycol, fat acid, acid salt, and basicity of an acid; give examples of each. Show by typical formulas the constitution of an alcohol, glycol; glycerine.
7. What peculiar properties adapt coal (carbon) to its use as fuel? State concisely how and whence its inherent energy is derived.
8. Describe the processes for preparing cast iron; wrought iron; steel by cementation; steel by Bessemer's process.
9. State what part carbon protoxide plays in metallurgy. Describe what changes take place in the candle-flame, and state what conditions must obtain when we wish to increase the light, and when we wish to increase the heat.

10. Name the substances represented by each of the following formula: H H , O O , H Cl , H_2O , H_2N , C H_4 , N O , C O_2 , S O_2 , H N O_3 , $\text{H}_2\text{S O}_4$, K H O , $\text{Ca H}_2\text{O}_2$, Na Cl , Ca Cl_2 , $\text{Na}_2\text{S O}_4$, K N O_3 .

11. Write a reaction by which ammonia can be obtained. What is ammonium? What elements are closely allied to it? Show what reasons we have for grouping them together.

HEAT.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1875.—*Time allowed, five hours.*

1. If a copper bar is 3.5 metres long at 15°F ., what will be its length at 40°C ., the coefficient of linear expansion by the centigrade scale being .000017?
How may the coefficient of apparent expansion of mercury be determined?
2. In correcting the barometric height for temperature, is the coefficient of real or apparent expansion of mercury used? A barometer stands at 750 millimetres at 18°C .; what is its corrected reading, the coefficient of expansion of mercury being .0001795?
3. What is the influence of pressure on the melting-point? Describe the Carré apparatus for making ice.
4. What is the weight of 4 litres of dry air at 20°C ., and pressure 745 millimetres, the dew-point being 10°C . and the tension of aqueous vapor at 10°C . being 9.165 millimetres?
5. What are Dalton's laws concerning the mixture of gases and vapors?
What common phenomena show that the atmosphere may contain aqueous vapor when the temperature of the air is below 0°C .?
What relation exists between the radiating and absorbing powers of a body? What substance will transmit nearly all luminous and non-luminous rays? What substance will cut off the luminous rays and transmit the non-luminous? What substance will cut off the non-luminous and transmit the luminous?
7. Deduce the corrected formula for determining specific heat by the method of mixtures.
8. A piece of metal weighing 200 grammes is heated to 100°C ., and then placed in 450 grammes of water of 15°C . The temperature of water and metal becomes 18°C ., and the water-equivalent of the apparatus is 5 grammes. What is the specific heat of the metal?
9. What will be the temperature of a mixture of 60 kilogrammes of iron of 75°C . and 10 kilogrammes of mercury of 25°C ., the specific heat of iron being .11 and of mercury .033?
10. If two cannon-balls of unyielding metal weighing 200 pounds each, flying in opposite directions, with velocities of 600 feet per second, meet in the air, what will be the amount of heat developed by the concussion, and through how many degrees will the temperature of the balls be raised, the specific heat of the metal being .115?

CHEMICAL ANALYSIS (QUALITATIVE).

ANNUAL EXAMINATION.

JUNE, 1875.—*Time allowed, five hours.*

1. H_2S is passed through different solutions with the following result: (1) Bright-yellow precipitate; (2) Dull-red precipitate at first, afterward turning to black; (3) At first, a white precipitate; finally, when saturated with H_2S , it was black. The precipitates were obtained in an acid solution and were found to be insoluble in ammonium sulphhydrate. What do the precipitates indicate?

2. Given a substance for analysis in the dry way: Metallic lustre, dull steel-gray color; easily crumbled; in closed tube melts and metallic-looking sublimate forms in globules on tube; by rubbing with a wire, these are brought together; slight residue on button, which is red-brown when hot and yellow when cold; heated on charcoal in oxidizing flame, a portion volatilizes and an incrustation is obtained, which is

orange-yellow when hot and yellow when cold; flame reaction, pale-blue. What substances are present? How would you get it into solution?

3. Given a solution of Cu Cl_2 and Zn S O_4 , to prove the presence of both acids and bases.

4. In identifying a substance, is it necessary to obtain it in the elementary condition? Show by illustrations what is the case.

5. Write a plan upon which the acids can, with but few exceptions, be classified. Give the special tests in the cases of the exceptions.

6. Describe the two methods for the separation of the members of class III, and give the principle upon which each depends. Which would you employ in practice? Why?

7. How can the silver in a solution containing copper be completely separated from the copper? Upon what does the separation depend? What is the law which explains the formation of a precipitate in a solution?

8. Give the members of the IV. class with the class reagent. What is the composition of the precipitate? What other substances are liable to be thrown down? In separating the members of this class, why should the mixture be allowed to cool and digesting the precipitate with $\text{H}_2\text{C}_2\text{O}_4$? What inferences may be drawn from the color of the original precipitate?

9. Given a solution containing the members of the VI. and VII. classes, to separate and determine. Why do you not look for the rest of class VII. in the filtrate from the Mg. precipitate? Give the reactions taking place.

10. Define reagent, class reagent, precipitate, precipitant, supernatant liquid, filtration, filtrate, and filter.

QUALITATIVE ANALYSIS (PRACTICAL).

Each student was given one of the following substances for analysis:

Silver coin.

Brass (boiler tube).

Type metal.

Tin amalgam.

Soft solder.

Nickel coin.

India and Chili saltpetre.

Alloy Zn + Pb.

Cubic saltpetre and salt.

ELECTRICITY AND MAGNETISM.

ANNUAL EXAMINATION.

JUNE, 1875.—Time allowed, five hours.

1. Suppose two Leyden jars in every respect alike, with their inner coatings in electrical connection, are charged negatively, the outer coatings being at the potential of the earth. If one of the jars be now insulated, and the potential of its outer coating raised by adding a positive charge, what changes will take place?

2. Electrical potential is one factor of energy. What is the other factor? Must there be electro-motive force without difference of potential?

3. What is the electrical capacity of a plate 16 centimetres in diameter and 4 centimetres from a parallel uninsulated plate? What is the quantity of electricity in absolute units on this plate if the potential is 6? What if mica be used as the dielectric?

4. What is meant by the specific inductive capacity of a dielectric? Of what importance is this in telegraphy?

5. What is the definition of unit of current in the electro-magnetic system?

6. Explain the formula $C = \frac{HK^2}{L} \tan \theta$.

7. If L, M, and T represent fundamental units of length, mass, and time, what are the derived magnetic units?

8. What is the ratio between the electro-magnetic and electro-static units of quantity, electro-motive force, and resistance?
9. What is an expression for the couple tending to turn a magnet suspended in a magnetic field at right angles to the lines of force? Define intensity of magnetization of a magnet.
10. What arrangement of 48 cells will produce the strongest current through a telegraph-wire of 25 ohms resistance? The dimensions of the cells are E. M. F = 1 volt and $B = 2$ ohms. What will be the strength of current measured in farads per second produced by this arrangement?
11. If a constant difference of potential of 12 volts be maintained between A and B, which are joined by three wires in multiple arcs of 4, 18, and 20 ohms resistance, respectively, what will be the total current flowing from A to B, and what proportion will flow through each wire?
12. What is the resistance of a galvanometer if a shunt of 82 ohms resistance reduces its sensibility 100-fold?
13. Prove the theory of the Wheatstone bridge by Kirchhoff's laws.
14. Upon what does the speed of signaling through a cable depend?
15. Give a method for locating a fault in a telegraph-line.
16. If one electro-magnetic unit of current will decompose .00092 gramme of water, how much copper per hour should a battery of 16 cells arranged in series deposit? The dimensions of the cells are as follows: E. M. F = 1 volt and the internal resistance 2 ohms. The external resistance is 6 ohms.

PRACTICAL EXERCISE IN THE LABORATORY.

1. Determine with this gold-leaf electroscope and a piece of sealing-wax whether this brass globe is positively or negatively electrified.
2. Fasten an arrow on this wire, which connects the plates of this Grove's battery, indicating the direction in which the current flows.
3. Hold the wire near this magnetic needle so that the marked end of the needle shall turn toward this block under the influence of the current.
4. A current flowing into this galvanometer, as indicated by the arrow, deflects the needle as the hands of a watch move. Move this coil toward this magnet so that the induced current shall produce a deflection in the same direction.
5. Work the Carré dielectrical machine, and explain its action.
6. Describe the action of the Clarke magneto-electrical machine.
7. Describe the construction and action of the Farmer dynamo-electrical machine, the key-board, and fuses.
8. Describe the astatic galvanometer.
9. Measure the internal resistance of this battery.
10. Measure the resistance of this wire by the Wheatstone-bridge method.
11. Illustrate with these coils the attraction and repulsion of parallel currents.
12. Work and describe the action of the inductorium.

SECOND CLASS.
STEAM-ENGINEERY.**ANNUAL EXAMINATION.**

JUNE 11, 1875.—*Time allowed, five hours.*

I. Given: length of stroke, 48 inches; initial pressure of steam, 28 pounds per square inch, per gauge; vacuum, 25 inches; cut-off, 35 inches from the commencement of the stroke. Required the mean pressure; mean unbalanced pressure; terminal pressure;

- Rhetoric, examination-paper, 72.
 Seamanship, Course in, 51.
 Seamanship, examination-papers, 65, 74, 80.
 Second class, Cadet-Midshipmen, relative standing, 16.
 Second class, Cadet-Midshipmen, 1874-'75, merit-roll, 33.
 Second class, Cadet-Engineers, 1874-'75, merit-roll, 37.
 Ship-building, Course in, 51.
 Ship-building, examination-paper, 72.
 Signals, Exercises in the use of, 51.
 Spanish, Course in, 54.
 Spelling, Examination for admission in, 42, 45, 46.
 Staff, Academic, 8.
 Steam-engineery, Course in, 52.
 Steam-engineery, examination-papers, 60, 95.
 Summary, 26.
 Surveying, Course in, 52.
 Swimming, Instruction in, 51.
 Tactics, Course in, naval and infantry, 51.
 Tactics, examination-papers, infantry, 76.
 Tactics, examination-papers, naval, 73.
 Text-books, 51, 52, 53, 54, 56.
 Theory of equations, examination-paper, 61.
 Third class, Cadet-Midshipmen, relative standing, 19.
 Third class, Cadet-Midshipmen, 1874-'75, merit-roll, 35.
 Third class, Cadet-Engineers, relative standing, 23.
 Traveling expenses, 43.
 Trigonometry, Course in, 52.
 Trigonometry, examination-papers, 68, 69.
 Visitors, Board of, 6.

INDEX.

- Academic Board, 11.**
Admission of Cadet-Midshipmen, Examination for, 39.
Admission of Cadet-Midshipmen, Regulations governing, 39.
Admission of Cadet-Engineers, Examination for, 47.
Admission of Cadet-Engineers, Regulations governing, 47.
Alert, Officers and Cadet-Engineers, U. S. S., 29.
Algebra, Course in, 52.
Algebra, Examination for admission, Cadet-Engineers, 48.
Algebra, examination-papers, 58, 59, 60.
Arithmetic, Examination for admission, 41, 44, 45, 46.
Artillery drills, 51.
Astronomy, Course in, 52.
Astronomy, examination-paper, 77.
Boxing, Instruction in, 51.
Cadet-officers, 11.
Calculus, Course in, 53.
Calculus, examination-papers, 78, 79.
Calendar, Academic, 6.
Calendar, Civil, 7.
Chemistry, Course in, 53.
Chemistry, examination-papers, 71, 92.
Coefficients, Table of, 30.
Competitive examination for admission of Cadet-Engineers, 48.
Constellation, Officers and Cadet-Midshipmen, U. S. S., 28.
Course of instruction, Cadet-Midshipmen, 51.
Course of instruction, Cadet-Engineers, 56.
Cruises, Practice, 28.
Dancing, Instruction in, 51.
Deaths, 27.
Deficient, Sections of fourth class, 1874-'75, 37.
Deposit on admission, 43.
Dismissals, 27.
Drawing, Course in, 54.
Drills, 51.
Elective course, 31, 52, 61.
Electricity, examination-papers, 77, 94.
English, Course in, 53.
English, examination-papers, 64, 65.
Examination-papers, 1874-'75, 58.
Expenses, 43.
Fencing, Instruction in, 51.
First class, Cadet-Midshipmen, relative standing, 14.
First class, Cadet-Midshipmen, 1874-'75, merit-roll, 32.
First class, Cadet-Engineers, relative standing, 25.
First class, Cadet-Engineers, 1874-'75, merit-roll, 37.
Fourth class, Cadet-Midshipmen, 22.
Fourth class, Cadet-Midshipmen, 1874-'75, merit-roll, 36.
Fourth class, Cadet-Engineers, 26.
Fourth class, Cadet-Engineers, 1874-'75, merit-roll, 38.
French, Course in, 54.
Geography, Examination for admission in, 41, 45, 46, 49.
Geometry, Course in, 52.
Geometry, Examination for admission in, Cadet-Engineers, 49.
Geometry, examination-paper, 61.
Geometry, Analytical, examination-papers, 70.
Graduating class, relative standing, Cadet-Midshipmen, 12.
Graduating class, relative standing, Cadet-Engineers, 24.
Grammar, Examination for admission in, 41, 44, 46, 49.
Gunnery, Course in, 51.
Gunnery, examination-papers, 76, 83.
Gymnastics, Instruction in, 51.
Heat, examination-papers, 87, 93.
Historical sketch, 5.
History, Course in, 53.
History, examination-papers, 62, 63.
Japan, Students from, 26.
Law, Course in, 53.
Law, examination-paper, 88.
Light and sound, examination-papers, 87.
Machine construction, examination-paper, 96.
Marine engines, examination-papers, 83.
Marine garrison, Officers of, 10.
Mates, 10.
Mechanics, Course in, 53.
Mechanics, examination-papers, 78, 79.
Merit-rolls, Explanation of, 31.
Mortar-practice, 51.
Natural philosophy, Examination for admission in, 50.
Naval architecture, examination-paper, 82.
Navigation, Course in, 52.
Navigation, examination-paper, 84.
Officers of the Naval Academy, 8.
Officers not attached to the Academic Staff, 10.
Ordnance instructions, examination-paper, 67.
Physics, Course in, 53.
Programme of studies, Cadet-Midshipmen, 55.
Programme of studies, Cadet-Engineers, 56.
Qualitative analysis, examination-paper, 93.
Resignations, 27.
Rhetoric, Course in, 54.

- Rhetoric, examination-paper, 79.
 Seamanship, Course in, 51.
 Seamanship, examination-papers, 65, 74, 80.
 Second class, Cadet-Midshipmen, relative standing, 16.
 Second class, Cadet-Midshipmen, 1874-'75, merit-roll, 33.
 Second class, Cadet-Engineers, 1874-'75, merit-roll, 37.
 Ship-building, Course in, 51.
 Ship-building, examination-paper, 72.
 Signals, Exercises in the use of, 51.
 Spanish, Course in, 54.
 Spelling, Examination for admission in, 42, 45, 46.
 Staff, Academic, 8.
 Steam-engineery, Course in, 52.
 Steam-engineery, examination-papers, 90, 95.
 Summary, 36.
 Surveying, Course in, 52.
 Swimming, Instruction in, 51.
 Tactics, Course in, naval and infantry, 51.
 Tactics, examination-papers, infantry, 58.
 Tactics, examination-papers, naval, 73.
 Text-books, 51, 52, 53, 54, 56.
 Theory of equations, examination-paper, 61.
 Third class, Cadet-Midshipmen, relative standing, 19.
 Third class, Cadet-Midshipmen, 1874-'75, merit-roll, 35.
 Third class, Cadet-Engineers, relative standing, 25.
 Traveling expenses, 43.
 Trigonometry, Course in, 52.
 Trigonometry, examination-papers, 68, 69.
 Visitors, Board of, 6.

2
15 ANNUAL REGISTER

3

GEORGE
1876

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

WENTY-SEVENTH ACADEMIC YEAR,

1876-77.



WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1876.



ANNUAL REGISTER

1265

OF THE

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

TWENTY-SEVENTH ACADEMIC YEAR,

1876-77.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1876.



CONTENTS.

	Page.
HICAL SKETCH.....	4
OF VISITORS.....	5
MIC CALENDAR.....	6
DAR, 1876-77.....	7
IRS.....	8
MIC BOARD.....	11
OFFICERS.....	11
S, WITH RELATIVE STANDING IN CLASSES.....	12
HICAL SUMMARY.....	26
TATIONS, DISMISSALS, AND DEATHS.....	27
L RIFLE-MATCH.....	29
CE-CRUISE, 1876.....	30
OF COEFFICIENTS.....	32
ROLLS, 1875-76.....	33
HTES FOR ADMISSION.....	42
E OF INSTRUCTION.....	55
AMME OF STUDIES.....	59
NATION-PAPERS, 1875-76.....	62
.....	101

THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by Hon. George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The course was fixed at five years, of which the first and last only were spent at the School, the intervening three being passed at sea. This arrangement was not strictly adhered to, the exigencies of the service making it necessary, in many cases, to shorten the period of study. In January, 1846, four months after the opening of the School, the students consisted of 36 Midshipmen, of the date of 1840, who were preparing for the examination for promotion; 13 of the date of 1841, who were to remain until drafted for service at sea; and 7 Acting Midshipmen, appointed since September of the previous year. The Midshipmen of the date of 1840 were the first to graduate, finishing their limited course in July, 1846, and they were followed in order by the subsequent dates, until the re-organization of the School, in 1851.

In September, 1849, a Board was appointed to revise the plan and regulations of the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. DuPont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation July 1, 1850.

The new organization provided for a course of seven years, the first two and last two at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, and its name was changed to the United States Naval Academy. The corps of professors was enlarged, the course was extended, and the system of separate departments, with executive heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Secretary of the Navy. A suitable vessel was attached to the Academy as a practice-ship, and the annual practice-cruises were begun.

After the system had been in operation a year new changes were proposed, and the recommendations of the Academic Board on the subject were referred to the Board of Examiners of the year 1851, composed of the following officers:

Commodore David Conner,
Captain Samuel L. Breese,
Commander C. K. Stribling,
Commander A. Bigelow,
Commander Franklin Buchanan,
Lieutenant Thomas T. Craven.

The change recommended by the Board of Examiners, and adopted by the Department, consisted mainly in leaving out the requirement of three years of sea-service.

the middle of the course, thus making the four years of study consecutive. The practice-cruises supplied the place of the omitted sea-service, and gave better opportunities of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in three years, and graduated in June, 1854; the rest of the class followed in 1855.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the Frigate *Constitution*. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision: March 1, 1867, it was placed under the direct care and supervision of the Navy Department; the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years, instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

There are now three classes of Cadet-Engineers at the Academy: the second, which entered in 1874 under the new law; and the third and fourth, admitted in 1875 and 1876, respectively.

BOARD OF VISITORS, JUNE, 1876.

Commodore DANIEL AMMEN, U. S. N., *President*.

General ROBERT B. POTTER, *Vice-President*.

D. C. GILMAN, L.L. D., President Johns Hopkins University.

General A. J. EDGERTON, of Minnesota.

General EDWARD C. ANDERSON, of Georgia.

Captain WILLIAM N. JEFFERS, U. S. N.

Colonel T. BAILEY MYERS, of New York.

Captain S. L. PHELPS, of the District of Columbia.

Captain OLIVER ELDREDGE, of California.

Rev. EDWARD D. NEILL, of Minnesota.

ACADEMIC CALENDAR.

1876-77.

1876.

Sept. 20.—Beginning of first term..... Wednesday.

1877.

Jan. 22-27.—Semi-annual examination..... Monday-Saturday.

Jan. 27.—End of first term..... Saturday.

Jan. 29.—Beginning of second term..... Monday.

June 10-20.—Annual examination..... Sunday-Wednesday.

June 20.—End of academic year 1876-77..... Wednesday.

June 21.—Examination of candidates for admission as Cadet-Midshipmen..... Thursday.

Sept. 5.—Examination of candidates for admission as Cadet-Engineers..... Wednesday.

Sept. 12.—Examination of candidates for admission as Cadet-Midshipmen..... Wednesday.

Sept. 20.—Beginning of first term 1877-78..... Thursday.

The academic months end on the following days:

1876-77.

October.....	Oct. 28	February.....	Mar.
November.....	Nov. 25	March.....	Mar.
December.....	Dec. 23	April.....	April
January.....	Jan. 20	May.....	June

1877-78.

October.....	Oct. 27	February.....	Mar.
November.....	Nov. 24	March.....	April
December.....	Dec. 22	April.....	May
January.....	Jan. 26	May.....	June

CALENDAR FOR 1876-77.

SEPTEMBER.							MARCH.						
S.	M.	T.	W.	T.	F.	S.	S.	M.	T.	W.	T.	F.	S.
3	4	5	6	7	8	9	4	5	6	7	8	9	10
10	11	12	13	14	15	16	11	12	13	14	15	16	17
17	18	19	20	21	22	23	18	19	20	21	22	23	24
24	25	26	27	28	29	30	25	26	27	28	29	30	31
OCTOBER.							APRIL.						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31	.....	.....	.....	.....	29	30	.....	.....	.....	.....	.....
NOVEMBER.							MAY.						
5	6	7	8	9	10	11	6	7	8	9	10	11	12
12	13	14	15	16	17	18	13	14	15	16	17	18	19
19	20	21	22	23	24	25	20	21	22	23	24	25	26
26	27	28	29	30	.....	.....	27	28	29	30	31	.....	.....
DECEMBER.							JUNE.						
3	4	5	6	7	8	9	3	4	5	6	7	8	9
10	11	12	13	14	15	16	10	11	12	13	14	15	16
17	18	19	20	21	22	23	17	18	19	20	21	22	23
24	25	26	27	28	29	30	24	25	26	27	28	29	30
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
JANUARY.							JULY.						
7	8	9	10	11	12	13	1	2	3	4	5	6	7
14	15	16	17	18	19	20	8	9	10	11	12	13	14
21	22	23	24	25	26	27	15	16	17	18	19	20	21
28	29	30	31	.....	.....	.....	22	23	24	25	26	27	28
.....	.....	.....	.....	.....	.....	.....	29	30	31	.....	.....	.....	.....
FEBRUARY.							AUGUST.						
4	5	6	7	8	9	10	5	6	7	8	9	10	11
11	12	13	14	15	16	17	12	13	14	15	16	17	18
18	19	20	21	22	23	24	19	20	21	22	23	24	25
25	26	27	28	.....	.....	.....	26	27	28	29	30	31	.....

OFFICERS OF THE UNITED STATES NAVAL ACADEMY.

REAR-ADMIRAL

CHRISTOPHER RAYMOND PERRY RODGERS,
SUPERINTENDENT.

COMMANDER NORMAN VON HELDREICH FARQUHAR,
Senior Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER EDWARD TERRY,
Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER HENRY LYCURGUS HOWISON,
Head of Department.

LIEUTENANT-COMMANDER SILAS WRIGHT TERRY,
LIEUTENANT-COMMANDER COLBY MITCHELL CHESTER,
LIEUTENANT-COMMANDER CHARLES VERNON GRIDLEY,
LIEUTENANT EUGENE DE FOREST HEALD,
Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,
Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER JAMES O KANE,
Head of Department.

LIEUTENANT-COMMANDER MERRILL MILLER,
In charge of practice-ships.

LIEUTENANT-COMMANDER BOWMAN HENRY MCCALLA,
LIEUTENANT DUNCAN KENNEDY,
LIEUTENANT THEODORUS BAILEY MYERS MASON,
LIEUTENANT ALBION VARETTE WADHAMS,
Instructors in Naval Gunnery and Infantry Tactics.

ANTOINE J. CORBESIER,
Sword-Master.

JEAN B. RETZ,
GEORGE HEINTZ,
Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR WILLIAM WOODBURY HENDRICKSON,

Head of Department.

LIEUTENANT-COMMANDER CHARLES WILLIAM KENNEDY,
 LIEUTENANT-COMMANDER SAMUEL HOUTON BAKER,
 LIEUTENANT SOCRATES HUMPHRIE, A. M.,
 LIEUTENANT JAMES HENRY DAYTON,
 LIEUTENANT CHARLES STILLMAN SPERRY,
 LIEUTENANT ROYAL RODNEY INGRESOLL,
 ENSIGN WILLIAM HENRY HUDSON SOUTHERLAND,
 ENSIGN JESSE MIMS ROYER,
 ENSIGN THOMAS BASTON HOWARD,

Instructors in Mathematics.

STEAM-ENGINEERING.

CHIEF ENGINEER CHARLES HENRY BAKER,

Head of Department.

PASSED ASSISTANT ENGINEER CHARLES HOWE GREENLEAF,
 PASSED ASSISTANT ENGINEER JOHN LIVINGSTON DINWIDDIE BORTHWICK, A. M.,
 PASSED ASSISTANT ENGINEER WILLIAM LEONARD NICOLL,
 PASSED ASSISTANT ENGINEER GEORGE EDWARD TOWER,
 PASSED ASSISTANT ENGINEER DAVID JONES,
 PASSED ASSISTANT ENGINEER CHARLES WHITESIDE RAE, C. E.,

Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

COMMANDER JOHN ADAMS HOWELL,

Head of Department.

LIEUTENANT-COMMANDER ALLAN DANVERS BROWN,
 LIEUTENANT CHARLES PLUMMER PERKINS,
 LIEUTENANT CHARLES GRIMES BOWMAN,

Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

COMMANDER WILLIAM THOMAS SAMPSON,

Head of Department.

LIEUTENANT-COMMANDER THEODORE FRELINGHUYSEN JEWELL,
 ENSIGN ALBERT ABRAHAM MICHELSON,
 PROFESSOR NATHANIEL MATSON TERREY, A. M., PH. D.,
 PROFESSOR CHARLES EDWARD MUNROE, S. B.,

Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR JOHN MINOT RICE, S. B.,

Head of Department.

LIEUTENANT HARRY KNOX,
 LIEUTENANT CHARLES CARPENTER CORNWELL,

Instructors in Mechanics and Applied Mathematics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR JAMES RUSSELL SOLEY, A. B.,

Head of Department.

LIEUTENANT EDWARD PARKER WOOD,
 LIEUTENANT JAMES MADISON MILLER,
 LIEUTENANT JOHN FORSYTH MEIGS,
 LIEUTENANT WILLIAM PARKER POTTER,
 LIEUTENANT JOHN BRADFORD BRIGGS,
 ENSIGN AUSTIN MELVIN KNIGHT,
 ASSISTANT PROFESSOR WILLIAM WIRT FAY, A. M.,
 ASSISTANT PROFESSOR ELIOT LORD, A. B.,

Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

PROFESSOR LUCIEN FRANKLIN PRUD'HOMME, A. M.,

Head of Department.

LIEUTENANT RICHARD CATTON DERRY,
 LIEUTENANT ARTHUR PHILLIPS NAZRO,
 MASTER AARON WARD,
 ASSISTANT PROFESSOR ALPHONSE V. S. COURCELLE,
 ASSISTANT PROFESSOR EUGENE DOVILLIERS,
 ASSISTANT PROFESSOR JULES LEROUX,
 ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

ASSISTANT PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR RICHARD SOMERS SMITH, A. M.,

Head of Department.

ASSISTANT PROFESSOR MARSHAL OLIVER,
 ASSISTANT PROFESSOR CHARLES FRANCIS BLAUVELT, N. A.,

Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF

MEDICAL INSPECTOR ALBERT LEARY GIBON, A. M., M. D.
 PASSED ASSISTANT SURGEON WILLIAM ALBERT CORWIN, M. D.
 ACTING PASSED ASSISTANT SURGEON JOSEPH JOHN SOWERBY, M. D.
 ACTING ASSISTANT SURGEON THOMAS OLIVER WALTON, M. D.
 PAYMASTER ALBERT SEWALL KENNY, A. B.
 PAYMASTER SAMUEL TRACY BROWNE, *Storekeeper.*
 CHAPLAIN ROBERT HUDSON, M. A.
 ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
 JAMES JOHNSON GRAFF, *Assistant Librarian.*
 RICHARD SWANN, *Commissary.*
 RICHARD MOALE CHASE, *Secretary.*

JAMES G. GLYNN, *First Clerk.*
 SAMUEL JACKLING, *Second Clerk.*
 CHARLES MARION MCLEOD, *Clerk to Commandant of Cadets.*
 EUGENE WORTHINGTON, *Third Clerk to Superintendent.*

MARINE GARRISON.

CAPTAIN McLANE TILTON, *Commanding.*
 FIRST LIEUTENANT WILLIAM SULLIVAN MUSE.
 FIRST LIEUTENANT JAMES MARMADUCE TERRET YOUNG.
 FIRST LIEUTENANT SAMUEL KUYPERS ALLEN.
 SECOND LIEUTENANT SAMUEL HOPPER GIBSON.

MATES.

C. J. MURPHY.....	} Attached to the United States Gunnership Ship and to the Sloop-of-war Dale.
SAMUEL GEE.....	
WILLIAM G. SMITH.....	
L. M. MELCHER.....	
JOHN B. BROWN.....	} Attached to United States Steamer Nantuxet (clad).
ROBERT SILVER.....	
BENJAMIN G. PERRY.....	} Attached to the United States Steamer (steam-tender).
JOSEPH ROUGERS.....	

ACADEMIC BOARD.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N.
 COMMANDER EDWARD TERRY, U. S. N.
 COMMANDER J. A. HOWELL, U. S. N.
 COMMANDER H. L. HOWISON, U. S. N.
 COMMANDER JAMES O'KANE, U. S. N.
 COMMANDER W. T. SAMPSON, U. S. N.
 CHIEF ENGINEER C. H. BAKER, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 PROFESSOR J. M. RICE, S. B., U. S. N.
 PROFESSOR J. R. SOLEY, A. B., U. S. N.
 PROFESSOR R. S. SMITH, A. M.
 PROFESSOR L. F. PRUD'HOMME, A. M.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER.

W. F. FULLAM.

CADET-LIEUTENANTS.

H. M. WITZEL.	O. G. DODGE.
J. M. ORCHARD.	W. D. DAVID.

CADET-MASTERS.

HIERO TAYLOR.	W. V. BRONAUGH.
A. G. WINTERHALTER.	ALFRED JEFFRIES.

ADJUTANT.

F. W. TOPPAN.

CADET-ENSIGNS.

F. M. BOSTWICK.	A. W. GRANT.
T. M. BRUMBY.	P. V. LANSDALE.

CADET-PETTY-OFFICERS.

First Captains of Gun's Crews.

R. C. Paris.	V. S. Nelson.	A. W. Dodd.
E. E. Wright.	B. W. Hodges.	F. B. Case.
J. P. Parker.	H. O. Dunn.	N. J. L. T. Halpine.
W. M. Constant.	F. R. Heath.	W. R. Rush.
H. H. Rodgers.	G. W. Denfeld.	W. S. Benson.
J. H. Oliver.		

Second Captains of Gun's Crews.

H. M. Dombaugh.	J. G. Quinby.	H. McL. P. Huse.
Simon Cook.	T. S. Rodgers.	C. N. Atwater.
G. F. Ormsby.	H. S. Knapp.	J. H. L. Holcombe.
A. C. Almy.	C. S. McClain.	Edward Lloyd.
J. H. Fillmore.	R. C. Smith.	P. B. Bibb.
J. H. Gleason.		

MIDSHIPMEN.

Graduating class of 1876—42 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Sea-service in practice-ships.			
				Years.	Months.	Seamanship.	Practical exercises.	Naval architecture.	Ordnance and armor.	Steam-engineering.	Navigation.	Light and heat.	Public law.	Spanish.	Number of demerits.	Months.	Days.
1.	Brown, Stimpson Joseph	New York	Sept. 16, 1872	17	11	14	14	5	1	1	5	1	3	1	119	6	11
2.	Gearing, Henry Chalfant	Pennsylvania	June 12, 1872	17	3	6	13	7	9	5	1	9	2	13	145	8	28
3.	Foulk, George Clayton	Pennsylvania	June 14, 1872	15	7	1	4	3	3	3	4	7	13	6	46	8	92
4.	Walling, Burns Tracy	Ohio	June 5, 1872	17	4	3	11	3	12	2	7	4	10	8	141	6	11
5.	Fotis, Tomplin Morris	At large	June 6, 1872	16	7	2	5	10	6	6	10	5	14	4	159	6	11
6.	Allen, William Herschell	Illinois	Sept. 26, 1872	15	10	9	11	6	7	16	6	3	5	5	85	6	11
7.	Scars, James Hamilton	New York	Sept. 20, 1871	16	8	9	8	8	14	4	9	14	16	27	133	8	25
8.	Jenkins, Stephen	New York	Sept. 20, 1871	14	2	14	7	14	10	7	11	22	1	15	112	8	25
9.	Winch, Thomas Garfield	Ohio	Sept. 20, 1872	17	10	5	5	1	4	11	8	15	11	16	90	6	11
10.	Boush, Clifford Joseph	Virginia	June 5, 1872	17	9	8	1	9	8	8	19	20	24	40	78	6	11
11.	Katz, Edward Marc	Wisconsin	June 8, 1872	16	7	21	26	21	11	12	24	9	11	3	158	6	11
12.	Rogers, Charles Cuslis	Tennessee	June 7, 1872	16	0	32	22	12	17	36	15	11	5	7	85	6	11
13.	McLean, Walter	At large	June 6, 1872	16	10	24	35	24	9	19	27	18	9	19	143	6	11
14.	Mays, Henry Thomas	Vermont	June 13, 1872	15	6	12	25	23	13	12	18	18	17	22	134	6	11
15.	Culver, Abraham Ella	New York	June 5, 1872	16	2	35	37	17	19	41	3	6	8	10	99	8	25
16.	Reynolds, Lovell Knowles	Alabama	June 5, 1871	14	4	4	4	5	19	10	29	25	19	25	150	8	25
17.	Varnum, William Laby	Pennsylvania	June 5, 1871	16	6	1	3	18	15	15	21	32	21	40	120	11	20
18.	Henderson, Richard	North Carolina	Sept. 28, 1872	17	1	24	18	16	17	17	5	17	33	19	74	6	11
19.	Pond, Charles Fremont	Connecticut	June 12, 1872	15	7	20	24	20	21	22	13	16	20	11	105	8	98
20.	Hollins, Anthony Wayne	Kentucky	June 16, 1872	12	3	13	20	20	27	35	13	11	22	27	100	0	90
21.	Gray, Robert Clark	At large	Dec. 3, 1872	15	0	16	20	20	26	17	24	26	25	32	103	0	34

[illegible]

Graduated September, 1876.

CADET-MIDSHIPMEN.

First class—46 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—										Sea-service in practice-ships.		
				Years.	Months.	Seamanship.	Ship-building.	Naval tactics.	Infantry tactics.	Astronomy.	Applied mathematics.	Electricity.	English composition.	French.	Spanish.	Number of demerits.	Months.	Days.
39	Benson, William Shepherd.....	Georgia.....	Sept. 21, 1873.....	16	11	27	40	47	51	47	44	26	48	50	44	147	9	13
14	Bostwick, Frank Matteson.....	Wisconsin.....	Sept. 26, 1873.....	16	5	39	16	45	50	8	23	14	8	52	14	204	5	27
12	Brice, Jonathan Kearley.....	Ohio.....	June 13, 1873.....	17	8	29	10	26	19	12	14	3	33	39	37	189	5	27
10	Bronaugh, William Venable.....	Kentucky.....	June 5, 1873.....	17	9	33	19	9	23	8	5	9	25	21	43	190	5	27
15	Brunaby, Thomas Mason.....	Georgia.....	Sept. 26, 1873.....	17	10	34	26	12	35	17	29	8	12	25	37	173	5	27
44	Burdick, William Leslie.....	Ohio.....	Sept. 26, 1873.....	16	9	36	18	51	56	43	51	32	11	43	50	217	5	27
34	Care, Frank Blair.....	Michigan.....	June 7, 1873.....	15	7	18	32	22	28	24	41	25	50	45	30	144	5	27
30	Constant, Walter Malher.....	Indiana.....	June 13, 1873.....	16	3	10	10	26	16	15	15	33	52	30	36	163	5	27
43	Cook, Simon.....	Missouri.....	June 6, 1873.....	16	11	51	53	38	40	51	47	50	31	50	37	95	5	27
7	David, William Glenn.....	New York.....	Sept. 25, 1873.....	17	2	50	3	6	8	4	7	10	6	6	11	150	5	27
21	Denfeld, George William.....	Massachusetts.....	Sept. 26, 1873.....	17	1	45	25	41	32	40	18	25	46	45	12	137	5	27
33	Dodd, Arthur Wright.....	Indiana.....	June 6, 1873.....	16	10	44	33	34	29	30	41	45	23	16	33	74	5	27
6	Dodge, Onenzo George.....	Kansas.....	June 13, 1873.....	17	0	1	6	4	5	2	9	7	38	39	29	96	5	27
42	Donbaugh, Harry Mason.....	Ohio.....	June 6, 1872.....	16	4	39	43	21	45	46	44	42	24	47	50	181	9	13
36	Dunn, Herbert Omar.....	Rhode Island.....	June 6, 1873.....	16	0	30	15	35	23	26	27	25	36	37	40	162	5	27
13	Fackelder, Augustus Francis.....	At large.....	June 5, 1873.....	15	0	24	36	11	32	13	10	35	3	6	13	185	5	27
1	Fullam, William Freeland.....	New York.....	Sept. 24, 1873.....	17	11	2	9	1	9	1	4	4	3	13	14	124	5	27
24	Gleaves, Albert.....	Tennessee.....	June 10, 1873.....	15	5	11	7	20	39	18	50	24	42	41	40	202	5	27
27	Grant, Albert Weston.....	Wisconsin.....	June 9, 1873.....	17	3	24	14	17	26	50	50	45	46	30	34	149	5	27
46	Hall, Alfred Lovell.....	Ohio.....	Sept. 16, 1872.....	17	11	21	43	40	40	30	33	38	54	38	40	153	9	13
36	Hudson, Nicholas John Lane Trower.....	New York.....	June 9, 1871.....	14	8	50	46	10	99	27	43	50	35	3	99	208	9	13

Sabbath.

16 CADET-MIDSHIPMEN, SECOND CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN.

Second class—43 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Chemistry and physics.	History and rhetoric.	French.	Drawing.				Months.	Days.
5	Alroy, Augustus Craven	At large	June 6, 1872	15	6	.....	.....	.....	.....	.....	.....	177	6	6	24
10	Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3	10	16	3	8	16	.....	125	5	8	8
17	Babb, Peyton Benajah	Alabama	June 12, 1874	17	3	15	24	14	10	37	.....	99	3	0	0
27	Biddle, Spencer Fullerton Baird	At large	June 13, 1874	15	5	24	27	35	31	3	.....	242	3	0	0
30	Canteloh, William Chas.	At large	Sept. 23, 1873	16	1	31	34	25	13	10	.....	128	5	8	8
37	Carrington, Austin Downs	Virginia	Sept. 23, 1873	17	5	38	35	37	28	40	.....	241	5	8	8
35	Clark, George Ramsey	Ohio	June 9, 1874	17	3	40	38	32	17	39	.....	241	3	0	0
33	Craven, John Echeleston	New Jersey	Sept. 24, 1874	13	10	21	22	39	40	16	.....	187	3	0	0
36	Dent, Balne Caruthers	At large	June 5, 1873	16	7	33	27	32	30	38	.....	222	5	8	8
36	Faulderoy, Robert Powell	At large	Sept. 23, 1873	16	5	38	37	30	38	12	.....	245	5	8	8
41	Fillmore, John Hudson	Illinois	Sept. 24, 1874	17	10	1	1	1	7	1	.....	130	3	0	0
32	Garrett, Charles Warren	Indiana	June 5, 1874	17	10	33	35	14	32	41	.....	202	3	0	0
42	Glennon, James Henry	California	Sept. 24, 1874	17	7	3	1	12	3	8	.....	70	3	0	0
41	Hall, William Edward Wyth	Maryland	June 14, 1873	17	3	38	38	37	42	26	.....	217	5	8	8
34	Hetherington, James Henry	Iowa	June 9, 1874	17	7	35	32	34	33	22	.....	166	3	0	0
11	Hidcombes, John Hite Lee	At large	June 27, 1874	17	0	16	7	16	9	34	.....	106	3	0	0
31	Hooker, Morathio Hill	Illinois	Sept. 26, 1874	17	0	30	23	31	35	30	.....	232	3	0	0
14	Huglowe, Richard Morris	Pennsylvania	Sept. 25, 1874	15	8	13	14	5	14	43	.....	250	3	0	0
9	Hunt, Harry McLaren Pinkney	New York	Sept. 30, 1874	15	10	11	5	8	1	6	.....	380	3	0	0

CADET-MIDSHIPMEN.

Third class—59 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English.	French.	Drawing.			Months.	Days.
5	Bayley, Prentice	Kentucky	Sept. 28, 1874	17	1	.....	.....	.....	.....	251		3	0
46	Backley, Richard Warren	Missouri	June 19, 1875	16	3	40	51	42	12	55		2	19
19	Barnard, Louis Hall	Colorado	June 13, 1874	16	11	24	12	25	44	79		2	19
6	Beale, Joseph	Pennsylvania	Oct. 12, 1874	14	10	6	11	28	36	267		2	19
11	Bell, John Arthur	West Virginia	June 13, 1874	16	11	9	21	9	43	168		2	19
44	Belmont, Oliver Hazard Perry	New York	Sept. 30, 1874	14	10	34	52	12	55	302		2	19
50	Bibber, Reuben Oscar	Pennsylvania	June 19, 1875	16	1	48	59	62	20	53		2	19
24	Bliss, John Bell	Indiana	Sept. 15, 1875	15	0	10	30	53	51	148		2	19
38	Brown, Guy Warner	Indiana	June 19, 1875	17	2	32	39	58	29	99		2	19
55	Buchanan, Wilson Wildman	Ohio	June 19, 1875	17	3	59	50	74	8	129		2	19
5	Caboon, James Blake	Vermont	June 10, 1874	17	6	.....	.....	.....	.....	115		3	0
14	Chase, Henry Sanders	Louisiana	June 21, 1875	16	10	19	13	25	11	108		2	19
4	Clements, Abner Brush	Missouri	June 21, 1875	17	6	1	14	40	25	144		2	19
40	Cramer, Ambrose	Maryland	Sept. 28, 1874	17	6	34	45	44	3	298		2	19
22	Cunningham, Andrew Charles	New York	June 9, 1874	16	4	19	25	44	4	41		2	19
23	Dougherty, John Allen	Missouri	June 12, 1874	16	9	19	20	44	26	64		2	19
33	Drayton, Percival Langdon	New York	June 10, 1874	16	2	42	38	5	16	328		2	19
32	French, George Ross	At large	June 21, 1875	17	11	51	42	61	63	101		2	19
23	Garrett, Leigh Osborn	New York	Sept. 13, 1875	15	1	49	61	44	45	192		2	19
21	Garrett, Le Roy Mason	New York	Sept. 10, 1875	18	0	17	30	90	9	144		2	19
32	Gibbons, John Henry	Michigan	Sept. 15, 1875	16	0	53	8	30	58	259		2	19
15	Gibson, John	Kentucky	Feb. 10, 1874	16	0	1	54	10	5	134		2	19

CADET-MIDSHIPMEN.

Third class—59 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.		Sea service in practice ships.	
				Years.	Months.	Mathematics.	English.	French.	Drawing.			Months.	Days.
45	Welsh, George Silva	Pennsylvania	Sept. 24, 1874	17	7	56	59	44	45	86		10	19
16	Wike, Harvey	Illinois	Sept. 16, 1875	14	3	5	58	42	50	973		10	19
10	Wilkinson, Ernest	Louisiana	June 19, 1875	17	6	11	16	8	18	206		10	19
2	Woodworth, Frederick Augustus	California	June 19, 1875	16	8	3	5	1	16	979		10	19

CADET-MIDSHIPMEN, FOURTH CLASS.

21

CADET-MIDSHIPMEN.

Fourth class—124 members.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
an. Albert Ammerman	New Jersey	June 21, 1876	16	11
Philip Rounseville .....	.....	Sept. 11, 1876	17	0
a. Horace Burlingame	Michigan	June 22, 1876	15	1
e. Henry Beckwith .....	.....	Oct. 3, 1876	15	4
William Frederic .....	.....	Sept. 19, 1876	15	8
John Bellamy	Florida	Sept. 15, 1875	16	7
r. Oscar Henry	Oregon	June 21, 1876	16	6
v. Francis Louis	Virginia	Sept. 14, 1875	16	4
m. John Baptiste	Delaware	Sept. 12, 1876	17	10
esley Erastus	Illinois	Sept. 11, 1876	17	1
John Craig	Pennsylvania	Sept. 20, 1875	16	1
Lot Clarke	Ohio	June 21, 1876	17	10
Herbert	Rhode Island	Sept. 15, 1875	16	7
George Preston	Virginia	Sept. 14, 1876	15	11
Thomas Lewis	Missouri	June 19, 1875	17	8
Frank Welch	Texas	Sept. 11, 1875	17	7
d. Frederick Roland	Illinois	June 21, 1876	17	9
Edward .....	.....	Sept. 11, 1876	16	3
Edmund Devening	New York	Sept. 11, 1876	17	7
James Stephen	Tennessee	Sept. 11, 1875	17	2
Samuel	Maryland	June 14, 1876	17	3
Howard Henry	Kentucky	Sept. 11, 1875	17	11
Charles	Virginia	June 21, 1876	16	8
Lewis Jacob	Alabama	Sept. 11, 1876	14	7
Rudolphus Rouse	Illinois	June 21, 1875	17	8
David Colebern Brodriek .....	.....	Sept. 11, 1876	17	5
Abbot Stanislaus	Illinois	Sept. 11, 1876	17	2
Paul Byram	New York	Sept. 13, 1875	16	4
Robert John	Indiana	Sept. 13, 1875	17	8
Ben Holliday	Missouri	June 14, 1876	16	8
Macdonough	New York	June 21, 1876	17	7
Edwin Peter	Missouri	June 14, 1876	17	2
edney Hope	District of Columbia	Sept. 11, 1876	15	7
Theodore Gibbs	At large	June 19, 1875	16	0
Joseph Morrill	Texas	June 14, 1876	15	5
George Lincoln	Iowa	June 19, 1876	16	1
Charles Augustus	New Hampshire	June 21, 1876	16	9
James Callum	Arkansas	June 14, 1875	17	11
Herman George	Ohio	Sept. 12, 1876	17	8
Louis .....	.....	Sept. 11, 1876	15	6
e. Honston .....	.....	Oct. 2, 1876	15	7
e. William Henry .....	.....	Oct. 10, 1876	16	4
William LeRoy .....	.....	June 26, 1876	16	11
Samuel Kennard	Rhode Island	Sept. 11, 1876	15	6
en. Horatio Ladd	South Carolina	June 19, 1875	16	1
Henry Marzette	Ohio	June 21, 1875	16	5
es. Allison DeFord	Indiana	June 21, 1876	17	2
e. Robert Pierpont	New York	June 21, 1876	16	11
Edward West	Tennessee	June 21, 1876	16	1

CADET-MIDSHIPMEN.

Fourth class—124 members—Continued.

Name.	State.	Date of admission.	Age at admission.	
			Yrs.	Mo.
Franklin, Thomas Baber	Tennessee	Sept. 15, 1873	17	
Garland, John Spotswood .....	.....	June 21, 1876	17	
George, Charles Penslee .....	.....	July 1, 1876	16	
Gilliam, Donnell	North Carolina	June 21, 1876	15	
Gray, James	Illinois	Sept. 12, 1876	17	
Gresham, William Albert	Indiana	June 19, 1873	17	
Haeseler, Francis Joy	Pennsylvania	Sept. 12, 1876	16	
Haines, Henry Cargill	District of Columbia	June 26, 1873	17	
Hains, Robert Peter .....	.....	Sept. 18, 1876	16	
Haskell, Porter David	Michigan	Sept. 12, 1876	17	
Hasson, Alexander Ritchie	At large	June 21, 1873	15	
Haymond, Edgar Bamford Wilson	Virginia	Sept. 12, 1876	15	
Hill, Charles Homer	Wisconsin	Sept. 14, 1876	16	
Houigan, Patrick William	New York	June 21, 1876	16	
Howze, Arthur Robertson	Mississippi	June 21, 1876	13	
Huntoon, Fitz-Anbert	Texas	Sept. 15, 1873	16	
Irving, Washington	New York	Sept. 14, 1873	15	
Jackson, Samuel Le Roy	Virginia	Sept. 11, 1873	16	
Jones, Henry George	Ohio	June 21, 1876	15	
Jones, Richard	New Jersey	June 19, 1873	16	
Kimball, Edward Fenno	South Carolina	June 21, 1873	15	
Lieper, Edwards Fayssoux	Pennsylvania	June 21, 1873	16	
Lindsey, John Howard	Pennsylvania	June 21, 1876	16	
Mahoney, James Edward	Massachusetts	Sept. 12, 1876	16	
Matthews, Thomas Henry	Pennsylvania	Sept. 12, 1876	16	
Mayer, Augustus Newkirk	Iowa	June 17, 1876	17	
McCrea, Alexander Sterling .....	.....	Oct. 2, 1876	17	
Miner, John Rice, Jr.	Ohio	June 21, 1876	15	
Morgan, Stokely	Arkansas	June 14, 1876	16	
Muir, William Carpenter Pendleton	Kentucky	June 21, 1876	17	
Murray, James Bernard	New York	Sept. 12, 1876	16	
Nash, Edwin White	Ohio	Sept. 11, 1876	16	
Niblack, Albert Parker	Indiana	Sept. 12, 1876	17	
Norton, Luman Spooner	Vermont	Sept. 12, 1876	17	
Oriopp, Max Anton	Arkansas	June 19, 1876	17	
Parke, Thomas Aloysius	West Virginia	June 21, 1876	16	
Parsons, Arthur Carlton	Iowa	June 21, 1873	17	
Patterson, Samuel Achmuty Wainwright .....	.....	June 21, 1876	18	
Perkins, Con Marrast	Georgia	Sept. 11, 1873	14	
Perry, George Ernest	Illinois	Sept. 12, 1876	16	
Perry, John Adams	Kansas	Sept. 11, 1876	17	
Phelps, Harry	New Jersey	Sept. 13, 1876	16	
Porter, John Pryor	Texas	Sept. 11, 1873	15	
Reamer, Mark McDonald .....	.....	June 27, 1876	15	
Richardson, Walter Gates	Massachusetts	Sept. 12, 1876	16	
Robinson, William Moody	District of Columbia	June 23, 1876	17	
Rodgers, Guy George .....	.....	Sept. 23, 1876	14	
Rodman, Hugh	Kentucky	Sept. 12, 1873	16	

CADET-MIDSHIPMEN.

Fourth class—124 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
cher, Joseph Hamilton	Pennsylvania	June 21, 1876	17	9
William Worthington	Maryland	Sept. 12, 1876	17	9
William Edwin	Ohio	Sept. 11, 1876	16	9
Richard Hamilton	Minnesota	June 21, 1876	17	9
William Sowden	Pennsylvania	June 21, 1876	17	8
n, Edward, jr. ....	.....	June 21, 1876	15	9
ff, Emile Arthur Vou	Missouri	July 31, 1875	17	11
John, jr.	Kentucky	Jan. 15, 1876	17	11
er, Herbert Wemple	Louisiana	Sept. 11, 1876	17	1
son, Edward Clinton	Pennsylvania	Sept. 13, 1875	17	4
n, William .....	.....	June 21, 1876	15	3
izer, Lewis Sayre	New York	Sept. 13, 1876	15	3
Zebulon Baird	North Carolina	June 22, 1876	16	0
Francis Richardson	Mississippi	June 23, 1876	16	11
e, John Thomas	Virginia	June 14, 1876	17	10
s, John Sproston .....	.....	June 21, 1876	14	11
George Ernest	New York	Sept. 12, 1876	14	5
ld, Jesse George	Alabama	Sept. 11, 1876	16	10
ell, Samuel Elmer	South Carolina	June 21, 1876	15	7
ames Frederick	Iowa	Sept. 11, 1876	17	3
nson, Benjamin Harris	Mississippi	Sept. 11, 1876	17	8
nson, Samuel Hill	North Carolina	Sept. 11, 1876	17	10
, Henry Braid	New Jersey	Sept. 11, 1876	15	7
berger, William Henry	Illinois	Sept. 12, 1876	17	7
James Edward	Alabama	Sept. 11, 1876	17	11
ngton, Thomas .....	.....	June 19, 1876	16	7
Silas Haynes	Michigan	June 25, 1876	17	10

CADET-ENGINEERS

Graduating class, 1876—3 members.

Name	State	Date of admission.	Age at date of admission.		Steam-engineering.	Electricity, Chemistry, and heat.	Order of merit in—			Number of demerits.	Sea-service in practice-ships.	
			Years.	Months.			Applied mathematics.	French.	Months.		Days.	
Eng. William Batey....	New York....	Oct. 1, 1873	19	2	2	3	1	2	2	59	3	9
ers, Henry Hicks.	New York....	Oct. 1, 1873	18	0	1	1	2	1	1	56	3	9
l, Robert Ingersoll.....	Pennsylvania	Oct. 1, 1872	20	2	3	2	3	3	3	56	3	9

CADET-ENGINEERS.

Second class—16 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	School record in practical subjects.	
				Years.	Months.	Mathematics.	Chemistry.	History and composition.	French.	Drawing.		Months.	Days.
6	Bartlett, Frank William.....	Michigan.....	Oct. 1, 1874	18	1	7	7	5	4	8	214	2	
9	Bieg, Frederick Charles.....	Missouri.....	Oct. 1, 1874	18	6	9	13	10	4	9	194	4	
*4	Bull, Goold Hoyt.....	Pennsylvania.....	Oct. 1, 1874	18	4	4	4	5	3	2	236	1	
15	Burd, George Eli.....	Massachusetts.....	Oct. 1, 1874	17	5	15	12	14	10	12	130	2	
12	Cooley, Mortimer Elwyn.....	New York.....	Oct. 1, 1874	19	6	12	6	15	9	5	153	2	
16	Dungan, Horace Greeley.....	Iowa.....	Oct. 1, 1874	20	6	14	16	17	17	15	168	2	
8	Gage, Howard.....	Michigan.....	Oct. 1, 1874	18	1	10	5	7	10	10	226	2	
10	Gow, John London.....	Indiana.....	Oct. 1, 1874	18	4	8	9	9	13	14	136	2	
7	Griffin, Robert Stanislaus.....	Virginia.....	Oct. 1, 1874	17	0	6	9	11	4	13	105	2	
*1	Hollis, Ira Nelson.....	Kentucky.....	Oct. 1, 1874	18	6	1	1	1	2	2	183	2	
13	Ivers, Henry King.....	Missouri.....	Oct. 1, 1874	18	6	16	13	8	13	6	123	2	
5	McElroy, George Wightman..	Michigan.....	Oct. 1, 1874	16	6	5	8	12	12	7	243	1	
*2	Schell, Franklin Jacob.....	Pennsylvania.....	Oct. 1, 1874	17	1	3	2	2	1	13	116	2	
*3	Spangler, Harry Wilson.....	Pennsylvania.....	Oct. 1, 1874	16	9	2	3	3	7	3	143	2	
14	Wight, Charles Leslie.....	Massachusetts.....	Oct. 1, 1874	21	1	13	11	13	16	4	222	2	
11	Wilmer, Joseph Ringgold.....	Maryland.....	Oct. 1, 1874	20	10	11	15	4	6	17	99	2	

CADET-ENGINEERS.

Third class—28 members.

Order of annual exam.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice ships.	
				Years.	Months.	Mathematics.	French.	History and composition.	Drawing.	Months.		Days.	
16	Acker, Edward O Connor	Pa.....	Sept. 15, 1875	17	4	16	28	8	7	52	2	20	
7	Annan, John Wesley.....	Mass.....	Sept. 15, 1875	19	0	12	5	6	15	125	2	20	
24	Baker, John Howard.....	R. I.....	Sept. 15, 1875	18	0	26	15	22	20	75	2	20	
19	Bartholow, Frank Lamotte.....	Ohio.....	Sept. 15, 1875	18	8	21	19	17	24	71	2	20	
5	Bennett, Frank Marion.....	Mich.....	Oct. 1, 1874	17	5	5	17	3	12	217	2	20	
23	Berington, Martin.....	Ohio.....	Sept. 15, 1875	17	10	22	24	21	18	114	2	20	
4	Bowles, Francis Tiffany.....	Mass.....	Sept. 15, 1875	16	11	4	4	4	10	56	2	20	
25	Bowers, Frederic Clay.....	N. J.....	Sept. 15, 1875	17	7	24	9	25	26	94	2	20	
8	Bryan, Benjamin Chambers.....	N. J.....	Sept. 15, 1875	17	1	6	11	14	14	93	2	20	
15	Carr, Clarence Alfred.....	Pa.....	Sept. 15, 1875	19	1	15	12	10	29	50	2	20	
27	Carter, Thomas Frederic.....	Ky.....	Oct. 1, 1873	21	0	28	26	26	17	41	2	20	
12	Crygier, John Ulysses.....	N. Y.....	Oct. 1, 1874	16	6	17	29	13	10	157	2	20	
9	Elseifer, Harry Smith.....	Iowa.....	Oct. 1, 1874	19	3	9	8	11	4	168	2	20	
11	Gatewood, Richard.....	Va.....	Sept. 15, 1875	15	11	1	1	1	13	70	2	20	
1	Harrison, Henry Fillmore.....	Md.....	Oct. 1, 1874	18	9	13	13	9	18	91	2	20	
7	Hogan, Thomas Joseph.....	Ga.....	Oct. 1, 1874	18	10	18	15	12	2	111	2	20	
6	Hunt, Andrew Murray.....	Ind.....	Sept. 15, 1875	16	2	10	6	7	9	86	2	20	
5	Isabester, Richard Thornton.....	Tenn.....	Sept. 15, 1875	18	3	26	21	20	22	262	2	20	
10	Lubbe, Charles Bethel.....	Pa.....	Sept. 15, 1875	18	3	7	12	14	4	91	2	20	
3	McFarland, Walter Martin.....	D. C.....	Sept. 15, 1875	16	1	2	2	2	20	62	2	20	
13	Mercier, David Isaiah.....	Va.....	Sept. 15, 1875	19	1	20	26	19	23	207	2	20	
14	Noell, Michael Daniel.....	Pa.....	Sept. 15, 1875	17	5	3	10	4	8	143	2	20	
17	Norton, Harold Percival.....	N. Y.....	Oct. 1, 1874	18	10	13	14	18	1	80	2	20	
18	Salisbury, George Robert.....	Mass.....	Oct. 1, 1874	19	7	7	19	24	16	57	2	20	
2	Scribner, Edward Herschell.....	Mass.....	Oct. 1, 1874	19	11	11	7	23	3	106	2	20	
22	Smith, William Strother.....	Va.....	Sept. 15, 1875	18	0	23	22	20	25	127	2	20	
21	Talbot, Charles Gratiot.....	Va.....	Sept. 15, 1875	16	0	18	23	27	6	113	2	20	
26	Yarnall, John Hepburn.....	D. C.....	Sept. 15, 1875	19	1	24	3	14	27	82	2	20	

CADET-ENGINEERS.

Fourth class—26 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing determined at examination for appointment.
			Years.	Months.	
Allderdice, William Hillary.....	Pennsylvania.....	Sept. 14, 1876	16	9	2
Arnold, Solon.....	Maryland.....	Sept. 14, 1876	22	2	23
Bailey, Horace Justus.....	District of Columbia..	Sept. 14, 1876	15	11	18
Belden, Charles Emory.....	Ohio.....	Sept. 14, 1876	18	6	38
Byrne, James Edwin.....	Massachusetts.....	Sept. 14, 1876	19	5	19
Durand, William Frederick.....	Connecticut.....	Sept. 14, 1876	17	8	7
Eckel, Herman.....	Ohio.....	Sept. 14, 1876	20	2	25
Hall, Harry.....	Pennsylvania.....	Sept. 14, 1876	17	9	22
Hasson, William Frederick Converse ..	Ohio.....	Sept. 14, 1876	19	4	5
King, Charles Alfred.....	Maryland.....	Sept. 14, 1876	18	1	3
Kinkaid, Thomas Wright.....	Ohio.....	Sept. 14, 1876	16	6	33
Lang, William.....	New York.....	Sept. 14, 1876	18	2	16
Lillebridge, Frederick May.....	Connecticut.....	Sept. 14, 1876	17	9	21
Manning, Charles Edward.....	New York.....	Sept. 14, 1876	17	6	14
Mathews, Clarence Herbert.....	Ohio.....	Sept. 14, 1876	19	7	11
Miner, Leo Dwight.....	Ohio.....	Sept. 14, 1876	17	7	8
Nichols, Arthur.....	New York.....	Sept. 14, 1876	19	5	2
Sample, Winfield Scott.....	Pennsylvania.....	Sept. 14, 1876	18	10	10
Smith, Albert Edward.....	Wisconsin.....	Sept. 14, 1876	17	8	8
Stahl, Albert William.....	New York.....	Sept. 14, 1876	19	8	1
Temple, Arthur Wallace [‡]	Massachusetts.....	Sept. 15, 1875	20	6	1
Weaver, William Dixon.....	Kentucky.....	Sept. 14, 1876	19	1	24
Wood, Joseph Learned.....	Virginia.....	Sept. 14, 1876	20	2	1
Woods, Arthur Tannatt.....	Massachusetts.....	Sept. 14, 1876	17	7	12
Worthington, John Leeds.....	Maryland.....	Sept. 14, 1876	18	3	14
Young, Albert Osborn.....	New York.....	Sept. 14, 1876	19	2	17

[‡] On sick leave.

SUMMARY.

Academic year 1876-77.

CADET-MIDSHIPMEN.	
First class.....	46 members.
Second class.....	43 members.
Third class.....	59 members.
Fourth class.....	124 members.
CADET-ENGINEERS.	
Second class.....	16 members.
Third class.....	25 members.
Fourth class.....	26 members.
Total.....	342

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States approved July 27, 1863.

RESIGNATIONS, DISMISSALS, AND DEATHS.

RESIGNATIONS.

-Midshipman Fletcher Hodges.....	Oct.	14, 1875
-Midshipman Henry C. Jones.....	Oct.	27, 1875
-Midshipman William S. Winchester.....	Nov.	11, 1875
-Midshipman Joseph L. Redfern.....	Nov.	30, 1875
-Midshipman William F. Endress.....	Dec.	16, 1875
-Midshipman William Morse.....	Jan.	4, 1876
-Engineer Henry O'Connor.....	Jan.	17, 1876
-Midshipman William Crosby.....	Feb.	2, 1876
-Midshipman John P. Boyd.....	Feb.	2, 1876
-Midshipman Alfred G. Morey.....	Feb.	2, 1876
-Midshipman Andrew S. Rowan.....	Feb.	5, 1876
-Midshipman David Bartlett.....	Feb.	5, 1876
-Midshipman Howard C. Boon.....	Feb.	5, 1876
-Midshipman Frederick P. Meares.....	Feb.	5, 1876
-Midshipman George H. R. Preble.....	Feb.	5, 1876
-Midshipman George D. Donnelly.....	Feb.	29, 1876
-Midshipman E. B. W. Haymond.....	March	8, 1876
-Midshipman W. O'N. P. Maury.....	March	29, 1876
-Midshipman A. W. Buffington.....	April	24, 1876
-Midshipman William W. Russell.....	May	17, 1876
-Midshipman James A. Schrum.....	May	20, 1876
-Midshipman Mark C. Castle.....	May	24, 1876
-Midshipman Lewis C. Fletcher.....	May	24, 1876
-Midshipman George H. Jess.....	May	24, 1876
-Midshipman John G. Mason.....	May	24, 1876
-Midshipman Lyman B. Messinger.....	May	24, 1876
-Midshipman William B. Osterhout.....	May	24, 1876
-Midshipman Arthur B. Tracy.....	May	24, 1876
-Midshipman James D. Sheeks.....	May	24, 1876
-Midshipman Charles S. Williams.....	May	24, 1876
-Midshipman E. O. C. Ord.....	June	29, 1876
-Midshipman H. F. Grabow.....	June	24, 1876
-Midshipman A. C. Macomber.....	June	23, 1876
-Midshipman E. D. Fitzgerald.....	June	23, 1876
-Midshipman James Gray.....	June	23, 1876
-Midshipman E. H. Olney.....	June	23, 1876
-Midshipman R. J. Breckinridge.....	June	23, 1876
-Midshipman H. D. Booth.....	June	23, 1876
-Midshipman A. C. Gilmour.....	June	23, 1876
-Midshipman Leonard L. Lott.....	June	23, 1876
-Midshipman James O'Brien.....	June	23, 1876
-Midshipman A. N. Patterson.....	June	23, 1876
-Engineer C. A. Millet.....	June	23, 1876
-Midshipman Nath. S. Roberts.....	Sept.	25, 1876
-Engineer J. M. Parker.....	Sept.	25, 1876

WITHDRAWN.

Japanese student Keizero Machida	Jan.	3, 1
Japanese student Kantaro Arima	July	28, 1

DISMISSALS.

Cadet-Midshipman Lovell H. Webb	Oct.	26, 1
Cadet-Midshipman Chester A. Mayer	Oct.	26, 1
Cadet-Midshipman Thomas Dickinson	Nov.	4, 1
Cadet-Midshipman Henry E. Baker	Nov.	4, 1
Cadet-Midshipman Stuart Aldrich	March	14, 1
Cadet-Midshipman Campbell M. Johnston	March	14, 1
Cadet-Midshipman David W. Jones	June	23, 1
Cadet-Midshipman John T. McNasser	June	23, 1
Cadet-Midshipman Albert N. Wood	Sept.	7, 1

DEATHS.

Cadet-Midshipman John P. Arnold	July	18, 1
---------------------------------------	------	-------

ACCEPTANCE OF RESIGNATIONS REVOKED.

Cadet-Midshipman W. L. Todd	Oct.	18, 1
Cadet-Engineer T. F. Carter	Dec.	21, 1

ADMITTED AFTER THE PUBLICATION OF THE REGISTER FOR 1875-76.

Cadet-Engineer Clarence Alexander Miller, of Virginia	Oct.	27, 1
---	------	-------

ANNUAL RIFLE-MATCH.

GRADUATING CLASS, JUNE, 1876.

class No. 1, United States Navy. Number of shots, 7.
 a. 400 yards. Highest score possible, 28.
 b. skirmisher, lying. Natural test. Centre counting 4, inner 3, and outer 2.
 Remington navy rifle.

	1.	2.	3.	4.	5.	6.	7.	Total.
Smith.....	4	4	3	2	4	4	4	26
Ward.....	3	4	2	4	4	4	3	24
Illmore.....	4	4	3	4	4	2	3	24
Wyo.....	2	4	4	3	4	3	4	24
Wise.....	3	4	3	2	3	4	4	23

Number of points made by the class of 42 men..... 654
 Total..... 162

SUMMER-CRUISE, 1876.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION

Commander EDWARD TERRY, *Commanding.*
Lientenant-Commander SILAS W. TERRY, *Executive Officer.*
Lientenant-Commander B. H. McCALLA, *Navigator.*
Lientenant J. H. DAYTON, *Senior Watch-Officer.*
Lientenant H. KNOX, *Watch-Officer.*
Lientenant C. P. PERKINS, *Watch-Officer.*
Lientenant W. P. POTTER, *Watch-Officer.*
Ensign W. H. SOUTHERLAND, *Watch-Officer.*
Ensign J. M. ROPER, *Watch-Officer.*
Ensign A. M. KNIGHT, *Watch-Officer.*
Surgeon H. N. BEAUMONT.
Assistant Surgeon D. N. BERTOLETTE.
Paymaster W. GOLDSBOROUGH.
Chaplain G. W. SMITH.
Boatswain ANDREW MILNE.
Gunner ROBERT SOMMERS.
Clerk to Commandant of Cadets C. M. McLEOD.
Paymaster's Clerk JAMES MCGREGOR.

CADET-MIDSHIPMEN.

First class (47).

W. S. Benson.	O. S. Dodge.	A. Jeffries.	W. R. Rush.
F. M. Bostwick.	H. M. Dombaugh.	H. A. Johnson.	H. Taylor.
J. K. Brice.	H. O. Dunn.	J. N. Jordan.	F. W. Toppan.
W. V. Bronaugh.	A. F. Fechteler.	K. Katz.	H. C. Wakenshaw.
T. M. Brumby.	W. F. Fullam.	J. G. Kunitomo.	P. J. Werlich.
W. L. Burdick.	A. Gleaves.	B. V. Lausdale.	J. C. Wilson.
P. B. Case.	A. W. Grant.	V. S. Nelson.	A. G. Winterhalter.
S. Cook.	A. L. Hall.	J. H. Oliver.	H. M. Witzel.
W. M. Constant.	N. J. L. T. Halpine.	J. M. Orchard.	A. N. Wood.
W. G. David.	H. W. Harrison.	R. C. Paris.	S. E. Woodworth.
G. W. Denfeld.	F. R. Heath.	J. P. Parker.	E. E. Wright.
A. W. Dodd.	B. W. Hodges.	H. H. Rogers.	

Second class (2).

W. L. Rodgers.	A. G. Rogers.
----------------	---------------

Third class (5).*

Barkley.	G. R. French.	J. F. Luby.	W. J. Sears.
Barnard.	L. M. Garrett.	R. F. Lopez.	R. S. Sloan.
Be.	L. O. Garrett.	C. C. Marsh.	T. Snowden.
Bell.	J. H. Gibbons.	W. J. Maxwell.	H. L. Sturdivant.
Belmont.	J. Gibson.	D. P. Menefee.	F. Swift.
Bittler.	W. A. Gill.	R. H. Miner.	W. A. Thom.
Blish.	M. C. Gorgas.	J. M. Moore.	E. H. Tillman.
Brown.	W. A. Graham.	J. A. Mudd.	E. B. Webster.
Buchanan.	C. H. Harlow.	C. C. Norris.	G. S. Welsh.
Case.	G. E. Harrison.	F. B. Parsons.	E. Wilkinson.
Clements.	E. E. Hayden.	M. L. Read.	H. Wike.
Cler.	J. Hood.	C. S. Ripley.	F. A. Woodworth.
Cunningham.	C. W. Jungen.	H. J. Robinson.	
Cougherty.	F. W. Kellogg.	R. P. Schwerin.	
Crayton.	W. N. King.	S. A. Scott.	

Constellation sailed from Annapolis Roads, June 26, for New York City; from there to New Bedford, Buzzard's Bay, Vineyard Haven, Mass., and Newport, R. I., and back to Annapolis September 14, 1876.

UNITED STATES PRACTICE-STEAMER MAYFLOWER.

Commander H. L. HOWISON, *Commanding*.
 Lieutenant DUNCAN KENNEDY.
 Lieutenant T. B. M. MASON.
 Medical Assistant Surgeon A. M. MOORE.
 Medical Assistant Engineer W. L. NICOLL.
 Medical Assistant Engineer DAVID JONES.

CADET-ENGINEERS.

Third class (2).*

Adams.	F. C. Bowers.	H. F. Harrison.	M. D. Noell.
Annan.	B. C. Bryan.	T. J. Hogan.	H. P. Norton.
Baker.	C. A. Carr.	A. M. Hunt.	G. R. Salisbury.
Bartholow.	T. F. Carter.	R. T. Isbester.	E. H. Scribner.
Bennett.	J. E. Crygier.	C. B. Lubbe.	W. S. Smith.
Brighton.	H. S. Elseffer.	W. M. McFarland.	C. G. Talcott.
Bowles.	R. Gatewood.	D. I. Mercier.	J. H. Yarnall.

Mayflower left her anchorage June 26, and accompanied the Constellation to sea; proceeded thence to the navy-yards at Norfolk, Va., and League Island; touched at Philadelphia and Chester, Pa., Edgemore and Wilmington, Del., the navy-yard, New Bedford, and Vineyard Haven, Mass., Newport Torpedo Station and Providence, R. I., New London, Conn., Cold Springs, and Newburgh, returning to New York City thence for the Chesapeake, and arrived at Annapolis September 15, 1876.

Table of coefficients to be applied to the final averages in each branch in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Coefficients.				Graduating maximum for required studies.
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship.....	Seamanship.....			12	12	120
	Naval Construction.....				8	
	Naval Tactics.....			2		30
Ordnance and Gunnery....	Ordnance Instructions.....			2		
	Infantry Tactics.....				14	180
	Ordnance and Armor.....	9				
Mathematics.....	Algebra and Geometry.....					180
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		18			
Steam-Engineering.....	Marine Engines.....				12	60
Astronomy, Navigation, and Surveying.....	General Astronomy.....			6		
	Navigation and Surveying.....				16	60
Physics and Chemistry....	Physics and Chemistry.....		8			
	Electricity.....			6		60
	Light and Heat.....				8	
Mechanics and Applied Mathematics.....	Mechanics and Applied Mathematics.....			14		30
English Studies, History, and Law.....	English and History.....	6				60
	History and Rhetoric.....		6			
	Composition.....			5		60
	Public Law.....				3	
Modern Languages.....	French.....	2	4	4		60
	Spanish.....			3	3	
Drawing.....	Line-Drawing and Topography.....	2				16
	Sketching.....		2			
Maximum for each year.....		76	152	228	304	768
Deduction for each demerit.....		.004	.007	.013	.03	

CADET-ENGINEERS.

Seamanship.....	Naval Construction.....			2		20
Mathematics.....	Algebra and Geometry.....	9				180
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		12			
	Mechanical Drawing.....	2	2			24
Steam-Engineering.....	Fabrication of Machinery.....					
	Designing of Machinery.....			18	20	24
	Marine Engines.....					
Astronomy, Navigation, and Surveying.....	General Astronomy.....			6		24
Physics and Chemistry....	Physics and Chemistry.....		8			16
	Electricity.....			6		
	Light and Heat.....				8	16
	Physical Measurements.....				7	
Mechanics and Applied Mathematics.....	Mechanics and Applied Mathematics.....			14		16
	Mechanics.....				11	
English Studies, History, and Law.....	English and History.....	6				60
	History and Rhetoric.....		6			
	Composition.....			5		60
	Public Law.....				3	
Modern Languages.....	French.....	2	4	4		60
	Spanish.....			3	3	
Maximum for each year.....		76	152	228	304	768
Deduction for each demerit.....		.004	.007	.013	.03	

MERIT-ROLLS FOR 1875-76.

Merit-rolls, made out yearly for each class, show the proficiency of the Cadets in each branch of study. The numbers given in the preceding table, showing the relative weight of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the Cadet for the year.

In the case of Cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 2.50.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

"Cadets who attain 85 per cent. of the multiple in any year shall be distinguished by a star affixed to their names on the merit-rolls."—(Regulations U. S. Naval Academy, § 150.)

Cadets whose names are marked thus (+) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

a denotes absence from examination.

CADET-MIDSHIPMEN.

Merit-roll of first class (42 members), annual examination, June, 1876, and general merit-roll for four years.

Order of general merit.	Name.	General aggregate										General aggregate for four years.									
		Seamanship.	Practical exercises.	Naval architecture.	Ordnance and armor.	Steam-engineering.	Navigation.	Light and heat.	Public law.	Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	S 16.09					
	Maxima	48	20	24	52	44	60	32	12	12		304	228	196.30	87.79						
1	Stimson J. Brown	40.08	16.25	21.84	46.67	38.94	52.20	27.84	10.32	10.32	3.57	261.10	194.54	170.48	81.03	707.15					
2	Henry C. Gearing	41.28	16.50	20.40	46.15	35.97	52.80	27.68	8.85	8.85	4.35	255.72	193.34	167.44	79.62	695.02					
3	George C. Foulk	41.16	19.25	21.12	45.89	37.18	50.25	24.40	9.78	9.33	4.38	256.88	194.08	163.55	79.48	687.69					
4	Burns T. Walling	42.00	16.90	21.36	41.21	37.40	49.65	25.52	9.90	9.12	4.23	248.37	187.40	146.02	77.31	679.56					
5	Templin M. Potts	42.24	17.90	19.86	43.55	35.75	47.40	24.88	9.75	9.81	4.77	246.37	185.60	164.21	80.27	676.45					
6	William H. Allen	40.44	16.90	20.64	43.42	33.55	47.80	26.08	10.26	9.48	2.55	248.92	185.35	164.21	73.30	670.78					
7	James H. Sears	40.44	17.65	20.16	40.56	36.63	47.55	23.68	10.83	8.73	3.99	240.59	180.44	165.26	75.11	669.93					
8	Stephen Jenkins	37.92	17.75	19.02	42.25	35.53	46.95	21.84	10.83	8.70	3.36	247.46	185.28	161.33	75.15	659.93					
9	Thomas G. Winch	41.52	17.90	22.26	44.46	34.10	48.30	23.44	9.87	8.70	2.70	247.55	179.43	155.70	73.80	656.96					
10	Clifford J. Boush	40.80	19.25	19.92	43.16	35.31	44.55	22.56	9.00	7.95	2.34	240.16	180.55	161.64	73.91	651.73					
11	Edward M. Katz	36.84	14.90	17.76	42.12	33.99	42.30	24.08	10.26	10.05	4.74	227.17	181.60	164.40	78.47	639.99					
12	Charles C. Rogers	35.16	15.15	19.50	39.78	39.47	45.90	23.84	9.96	8.59	2.55	226.42	181.43	163.29	80.25	639.99					
13	Walker McLean	35.76	13.50	17.64	42.90	33.09	41.85	22.80	9.45	8.43	4.29	221.64	174.87	163.61	79.62	632.74					
14	Henry T. Mayo	38.76	15.00	17.70	41.08	33.99	44.85	22.80	10.08	8.97	4.63	228.04	178.78	150.23	76.58	631.58					
15	Abraham E. Culver	34.92	13.40	18.54	39.39	38.33	51.15	24.64	9.36	8.40	4.50	231.22	175.01	154.16	67.73	628.91					
16	Lovell K. Reynolds	41.64	18.85	19.36	40.65	34.43	41.55	21.63	9.27	7.95	3.92	231.46	172.17	153.52	67.92	627.50					
17	William L. Varnum	42.96	19.00	18.36	40.04	33.66	43.05	20.80	9.46	8.88	4.35	231.66	172.50	142.30	67.80	617.80					
18	Richard Henderson	36.48	15.65	17.04	38.74	32.34	46.35	23.04	9.27	8.31	3.77	221.65	169.44	151.72	71.94	616.41					
19	Charles F. Pond	34.44	13.65	17.04	38.74	32.34	46.35	23.04	9.27	8.31	3.77	221.65	169.44	151.72	71.94	616.41					
20	Anthony W. Rollins	38.16	13.25	17.04	38.74	32.34	46.35	23.04	9.27	8.31	3.77	221.65	169.44	151.72	71.94	616.41					
21	Robert C. Ray	35.64	13.65	16.62	39.91	33.34	45.90	21.68	9.27	8.31	3.77	221.65	169.44	151.72	71.94	616.41					
22	John T. Newell	36.48	16.25	16.56	37.23	31.24	39.30	21.68	8.70	10.11	4.71	214.04	168.38	144.36	74.09	606.89					
23	William D. Ross	35.16	12.90	19.30	41.33	33.00	46.35	24.40	9.09	8.43	3.21	233.83	166.31	141.09	68.81	602.09					
24	James C. Gillman	37.24	14.00	17.85	38.35	29.59	41.55	21.76	8.97	8.25	1.86	215.58	162.35	156.28	67.58	595.79					
25	Daniel R. C.	37.24	15.00	17.85	38.35	29.59	41.55	21.76	8.97	8.25	1.86	215.58	162.35	156.28	67.58	595.79					
26	Augustus R. Jarling	37.24	14.00	17.85	38.35	29.59	41.55	21.76	8.97	8.25	1.86	215.58	162.35	156.28	67.58	595.79					
27	Stephen B. Mallory	36.00	13.75	18.78	38.61	31.35	46.35	23.92	7.94	8.01	4.39	215.10	164.29	134.47	67.90	582.36					
28	Washington L. Chamberlain	37.08	13.75	18.78	38.61	31.35	46.35	23.92	7.94	8.01	4.39	215.10	164.29	134.47	67.90	582.36					
29	Francis H. Sherman	37.08	13.75	18.78	38.61	31.35	46.35	23.92	7.94	8.01	4.39	215.10	164.29	134.47	67.90	582.36					
30	Charles A. Gove	37.08	13.75	18.78	38.61	31.35	46.35	23.92	7.94	8.01	4.39	215.10	164.29	134.47	67.90	582.36					
31	George H. Sawyer	37.08	13.75	18.78	38.61	31.35	46.35	23.92	7.94	8.01	4.39	215.10	164.29	134.47	67.90	582.36					
32	De Witt Corbitt	36.72	13.45	18.78	38.61	31.35	46.35	23.92	7.94	8.01	4.39	215.10	164.29	134.47	67.90	582.36					

35	Henry Minett	34.44	13.65	16.80	36.40	31.70	45.60	30.64	10.36	8.06	8.50	312.04	161.50	136.90	64.04	576.34
36	William G. Hammon	34.44	11.65	17.16	37.53	32.01	45.60	17.84	8.04	8.04	8.75	314.12	154.34	146.30	65.59	574.02
37	Richard W. Mulligan	34.30	13.75	15.78	37.31	31.57	41.70	23.04	7.71	0.00	8.40	317.93	137.72	137.03	67.10	570.36
38	William S. Hoeg	35.28	14.40	16.74	36.97	31.79	39.45	30.68	8.31	8.16	8.70	318.34	132.59	140.01	57.04	560.41
39	Elstner N. Foster	32.64	13.40	15.74	34.66	32.12	39.90	31.70	8.22	8.70	8.70	302.74	157.91	137.03	63.62	562.14
40	Edward E. Wiso	33.00	12.90	16.74	36.66	32.45	40.80	23.76	8.10	8.07	8.07	308.55	155.74	137.03	59.88	561.41
41	Thomas D. Griffin	33.00	12.40	16.56	33.41	31.02	39.30	19.04	8.56	7.92	4.53	198.52	156.90	135.01	58.81	550.34
†	William Braumersreuther	35.88	14.25	15.30	33.41	27.83	38.25	21.28	8.10	8.82	1.89	198.50	155.45	134.46	61.47	540.07
			17.40	15.84	35.10	29.70	34.50	18.08	8.49	8.07	4.11	198.95	152.86	110.73	53.03	534.57

CADET-MIDSHIPMEN.

Merit-roll of second class (54 members), annual examination, June, 1876.

Order of annual merit.	Name.	Subjects.										Aggregate.	
		Seamanship.	Naval tactics.	Ship-building.	Infantry tactics.	Astronomy.	Electricity.	Applied mathematics.	English composition.	French.	Spanish.		Conduct.
	Maxima.....	28.00	8.00	16.00	8.00	24.00	40.00	56.00	20.00	16.00	12.00		228.00
1	William F. Fullam	85	7.96	13.60	7.96	96	35.40	49.00	17.80	12.56	9.37	1.61	198.65
2	Hiero Taylor	82.61	6.64	13.76	6.42	91.18	36.80	50.92	16.20	12.52	9.84	1.30	194.69
3	Russell C. Paris	80.16	6.40	11.92	6.72	90.94	35.00	52.08	17.15	14.48	10.62	2.25	193.22
4	Hornace M. Witzel	79.45	6.12	13.04	7.08	91.72	35.30	50.36	15.25	12.84	9.39	1.12	192.93
5	John M. Orchard	78.73	7.16	12.96	7.30	90.52	36.00	44.38	15.90	12.84	8.97	2.26	186.80
6	Onesozo G. Dodge	78.07	7.04	12.60	6.82	92.90	34.80	43.12	14.30	10.72	8.82	1.25	185.14
7	William G. David	77.14	6.76	13.08	6.70	91.54	34.60	44.38	17.70	13.94	9.36	1.95	184.55
8	Albert G. Winterhalter	76.71	5.96	12.32	6.92	90.58	30.40	45.92	17.15	13.82	10.71	1.59	184.25
9	Alfred Jeffries	76.41	6.64	11.48	6.36	88.66	32.30	40.40	15.85	13.52	10.23	0.77	180.70
10	William V. Bromnagh	76.21	6.76	12.46	6.74	88.84	33.70	45.92	15.55	11.80	8.40	2.47	178.13
11	John N. Jordan	75.44	6.62	12.94	6.62	90.28	35.50	40.92	14.80	12.56	9.84	2.46	176.04
12	Jonathan K. Erice	75.38	5.88	10.56	5.78	90.36	42.70	37.92	17.80	13.24	9.30	2.40	172.14
13	Augustus F. Fechteler	74.81	5.30	11.02	5.98	89.84	31.00	37.52	17.30	11.76	9.27	2.65	167.85
14	Frank M. Boswick	74.30	6.46	11.04	5.76	88.84	34.10	36.52	16.70	11.48	8.92	2.55	167.77
15	Thomas M. Brumby	73.45	6.02	10.60	5.74	88.06	37.90	39.34	15.95	12.80	9.33	1.70	167.49
16	Edward E. Wright	73.43	6.02	11.56	6.46	87.90	37.10	37.60	16.70	12.80	9.33	2.50	167.49
17	Albert N. Wood	72.49	5.98	11.28	6.36	86.90	36.90	37.10	18.25	12.72	9.62	1.47	166.61
18	James P. Parker	72.19	5.86	11.48	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
19	Sollin E. Woodworth	72.05	5.96	11.48	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
20	Harry C. Wakenshaw	71.54	5.92	12.24	6.20	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
21	Walter M. Constant	71.14	6.18	10.84	5.78	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
22	Henry H. Rogers	70.67	6.42	10.32	5.18	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
23	James H. Oliver	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
24	Valentine S. Nelson	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
25	Albert Gloaguen	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
26	Augustus C. Macomb	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
27	Benjamin W. Hodges	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
28	Herbert O. Dunn	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
29	Albert W. Grant	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
30	Philip Van H. Canadiah	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41
31	Frank W. Vesper	70.67	5.50	10.60	6.08	86.90	35.90	35.84	18.15	12.40	9.67	1.94	166.41

32	Frank W. Stoney	21.40	2.84	10.88	6.42	16.62	28.43	25.04	14.79	11.52	5.97	1.70	138.82
33	George W. Duffield	18.90	2.50	11.08	5.74	16.50	28.69	25.30	14.79	11.52	5.97	1.70	137.16
34	Horace W. Harrison	18.92	6.41	10.08	5.74	16.74	27.69	25.94	17.60	11.70	6.73	1.78	126.50
35	Arthur W. Dodd	18.97	5.74	10.64	5.90	17.62	28.30	25.42	15.70	13.44	6.77	0.77	120.54
36	Frank R. Glase	19.26	5.00	10.80	5.52	16.39	28.80	25.42	13.55	10.40	6.10	1.87	116.40
37	Henry A. Johnson	19.35	5.46	11.05	5.58	16.42	28.38	25.14	13.55	10.70	6.10	1.74	115.58
38	David W. Jones	19.35	5.46	11.30	5.60	17.42	27.30	25.14	12.45	13.08	6.35	3.62	114.96
39	Nicholas J. L. T. Halpin	20.14	6.10	10.30	5.80	17.10	27.00	25.00	14.55	13.72	6.00	2.70	113.71
40	John C. Wilson, Jr.	20.30	5.00	11.26	5.22	16.40	27.40	26.42	13.50	13.92	6.64	2.43	112.61
41	William R. Rush	20.42	6.10	11.36	5.46	16.44	27.00	26.40	13.05	13.32	6.77	2.64	112.00
42	William S. Benson	20.72	5.22	10.16	5.66	16.08	27.10	25.14	12.75	10.42	6.77	1.61	112.71
43	Alfred L. Hall	20.74	5.10	10.04	5.54	17.22	27.30	25.00	14.45	11.80	6.97	2.59	112.04
44	Perceval J. Werlich	20.44	5.00	9.65	5.50	16.09	27.30	25.00	14.05	10.72	7.03	2.40	110.91
45	Harry M. Donbaugh	19.81	6.04	10.01	5.48	16.30	26.90	25.98	13.40	10.40	7.03	2.40	110.91
46	John H. McNaeser	17.85	5.56	8.80	5.40	13.78	26.30	25.98	13.05	10.04	7.71	2.00	107.16
47	Simon Cook	18.62	5.54	10.32	5.54	14.38	25.40	23.46	13.65	10.12	6.52	1.54	105.59
48	Koroka Katz	18.69	5.52	10.04	5.52	14.09	25.40	23.00	14.40	10.12	6.52	1.54	105.59
49	Giro Kuntomo	16.63	5.46	9.34	6.08	12.30	20.30	24.44	17.60	12.59	6.85	1.22	101.24
50	George F. Ormsby	20.16	5.04	11.52	5.30	16.50	26.30	24.58	16.75	10.68	6.00	1.69	105.36
51	William L. Burdick	17.06	6.42	10.00	4.68	17.24	25.00	24.52	15.60	11.06	6.21	2.63	104.91
52	Hermann F. Grabo	19.55	5.10	10.00	5.35	16.09	25.20	23.50	10.10	10.92	6.21	1.63	104.04
53	William B. Odenbont	16.52	5.00	8.32	5.12	15.06	26.30	22.90	14.30	10.29	6.07	2.30	100.57
54	Augustus C. Almy	16.52	5.00	8.32	5.12	15.06	26.30	22.90	14.30	10.29	6.07	2.30	100.57

CADET-MIDSHIPMEN.

Merit-roll of third class (44 members), annual examination, June, 1876.

Order of annual merit.	Name.	Mathematics.	Chemistry.	History, composition, and rhetoric.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	72	32	24	16	8		144
*1	J. H. Fillmore	73.44	30.00	21.42	12.64	6.72	0.91	143
*2	J. H. Glennon	66.00	30.00	19.20	13.52	6.16	0.49	134
*3	J. G. Quinby	69.66	27.76	19.56	11.84	5.54	1.56	132
*4	T. S. Rodgers	65.88	26.80	20.64	14.88	5.36	0.96	132
5	H. S. Knapp	59.94	26.80	20.94	12.68	6.14	1.63	124
6	C. S. McClain	62.82	25.92	19.50	11.08	6.00	1.21	124
7	R. C. Smith	61.38	25.92	17.64	12.92	6.20	0.29	123
8	F. J. Sprague	57.42	29.04	19.92	10.92	6.54	1.76	122
9	H. McL. P. Huse	54.36	27.92	19.56	15.04	6.20	1.46	120
10	C. N. Atwater	55.26	26.08	20.70	12.44	5.80	0.77	119
11	J. H. L. Holcombe	52.92	27.04	19.50	12.28	5.34	0.74	116
12	Edward Lloyd, Jr.	54.18	23.28	19.74	13.32	5.78	0.52	113
13	Harry Kimmell	54.36	28.00	17.10	11.60	5.42	1.08	113
14	R. M. Hughes	54.18	25.60	20.40	11.72	5.06	1.25	112
15	F. L. Young	57.96	21.60	18.18	10.84	6.64	0.50	112
16	F. C. Skidner	51.30	25.68	18.78	11.20	6.32	1.94	112
17	P. B. Bibb	53.46	22.64	18.18	12.24	5.26	0.89	111
18	W. L. Rodgers	52.02	25.60	17.46	11.20	5.44	1.64	109
19	R. K. Wright	51.84	22.48	17.46	12.04	5.94	1.74	108
20	W. P. White	52.38	24.96	15.30	10.20	5.80	1.33	107
21	J. H. Shipley	50.94	22.32	17.52	11.08	5.72	1.04	106
22	T. W. Ryan	50.04	23.20	16.86	11.52	6.10	1.36	105
23	J. J. Knapp	50.22	23.36	17.94	10.12	5.18	1.13	103
24	J. E. McDonnell	49.32	24.72	16.14	10.68	5.30	0.66	103
25	J. E. Craven	50.94	22.96	15.84	10.08	5.20	1.31	102
26	George Sparhawk	49.68	21.20	17.58	10.60	5.94	0.88	101
27	S. F. B. Biddle	50.04	22.08	16.14	10.52	6.52	1.69	101
28	W. L. Todd	49.50	23.12	16.92	10.20	5.28	1.20	100
29	H. C. Poundstone	50.04	21.04	17.22	11.90	5.38	1.41	100
30	W. L. Canfield	48.24	20.88	17.28	11.80	6.10	0.50	100
31	H. H. Hooke	49.14	22.80	16.50	10.32	5.66	1.62	100
32	C. W. Garrett	47.52	20.80	18.18	10.48	5.12	1.44	100
33	B. C. Dent	47.52	22.08	16.44	10.56	5.18	1.53	100
34	J. H. Hetherington	47.16	21.12	16.26	10.40	5.76	1.16	99
35	G. R. Clark	46.08	20.56	17.46	11.36	5.16	1.69	98
36	R. P. Fauntleroy	46.26	23.72	16.74	10.12	6.00	1.71	98
37	A. D. Carrington	46.26	20.80	15.90	10.60	5.14	1.69	97
38	G. H. Stafford	44.46	21.92	18.66	11.04	5.40	0.62	100
39	A. G. Rogers	48.24	19.60	15.84	11.24	5.02	1.71	97
40	J. L. Purcell	46.44	20.48	16.32	9.88	5.70	1.25	97
41	W. E. W. Hall	46.44	20.56	15.90	9.64	5.78	1.81	96
42	Prentice Bailey	43.38	17.76	15.78	10.40	5.72	1.74	94
43	J. G. Mason		20.16			5.42	1.47	94
44	J. B. Cahoon					5.20	0.82	94

CADET-MIDSHIPMEN

Merit-roll of fourth class (69 members), annual examination, June, 1876.

Name	Mathematics.	English and his- tory.	French.	Drawing.	Conduct.	Aggregate.
61	36	24	5	5		70
Hood	31.30	23.10	5.00	5.00	30	64.04
rick A. Woodworth	32.40	23.10	5.75	5.75	1.12	64.92
eph H. Miner	32.97	23.50	5.74	5.62	.20	64.43
W. Clements	34.57	18.75	5.00	5.00	.75	62.41
rd E. Hayden	29.55	21.50	5.42	5.17	.45	61.91
h Beale	30.06	19.50	5.34	5.46	1.07	59.29
W. Jungen	29.54	19.44	5.76	5.75	.78	59.09
S. Ripley	29.88	17.50	5.45	6.22	.42	58.92
C. Marsh	29.60	21.50	5.24	5.40	.56	58.47
r Wilkinson	29.67	18.42	5.00	5.00	.22	58.39
A. Bell	29.70	18.75	5.25	5.00	.07	58.36
S. Sloan	29.80	18.12	5.42	5.50	.74	57.37
M. Moore	29.18	20.50	5.22	5.11	.55	57.34
S. Chase	29.54	18.44	5.40	5.80	.43	57.11
Gibson	29.33	17.75	5.00	5.02	.74	57.09
y Wike	29.24	17.40	5.00	5.24	1.00	56.85
e P. Schwerin	29.87	17.50	5.00	5.00	.40	56.81
W. J. Robinson	29.60	18.75	5.00	5.00	.40	56.74
H. Barnard	29.00	18.38	5.36	5.34	.32	56.76
P. Menefee	29.14	19.00	5.14	5.12	.41	56.42
W. M. Garrett	29.08	17.25	5.54	5.84	.50	56.16
W. C. Cunningham	29.74	17.04	5.12	5.00	.16	56.02
A. Dougherty	29.54	18.00	5.00	5.00	.50	55.90
B. Blish	29.43	18.00	4.80	5.00	.50	55.46
W. H. Harlow	29.56	18.10	5.10	5.44	1.14	55.06
rd H. Tibbuan	29.71	18.44	4.00	4.00	.04	54.66
E. Harrison	29.80	18.12	5.00	5.00	1.50	54.16
L. Sturdevant	29.80	17.75	5.14	5.00	1.10	53.90
e A. Scott	29.11	18.24	4.00	5.00	.00	53.43
Bin Swift	29.73	18.00	5.00	5.10	.00	53.31
W. A. Graham	29.40	18.00	4.00	5.00	.50	53.23
C. Gorgas	29.30	18.44	5.24	5.00	.00	53.04
al L. Drayton	29.40	18.00	5.00	5.00	1.31	52.80
W. A. Gill	29.80	18.22	4.00	5.02	.50	52.65
H. Gibbons	29.58	18.00	5.00	5.00	1.10	52.69
F. F. Lopez	29.18	18.00	4.44	4.00	.94	52.51
B. Webster	29.74	18.00	5.00	5.00	1.12	52.44
V. Brown	29.70	18.00	4.75	5.00	.40	52.43
rs Snowden	29.70	18.00	5.00	5.00	.41	52.22
ose Crater	29.80	18.00	5.00	5.00	1.07	52.14
C. J. Norris	29.74	18.00	5.00	5.00	.50	52.14
L. Read	29.40	18.00	5.10	5.00	.00	52.00
is W. Kellogg	29.70	18.00	5.00	5.00	.00	51.90
H. P. Belmont	29.80	18.00	5.00	5.00	1.31	51.92
W. Welch	29.70	18.00	5.00	5.00	1.00	51.70
rd W. Butler	29.40	18.00	5.00	5.00	.00	51.40
W. A. Tamm	29.10	18.00	5.00	5.00	.00	51.10
J. S. S. S.	29.70	18.00	4.00	5.00	.40	51.47
E. Parsons	29.40	18.00	5.00	5.00	.50	51.30
O. Butler	29.40	18.00	4.00	5.00	.00	51.40
A. Mead	29.70	18.00	5.00	5.00	1.00	51.62
R. French	29.70	18.00	5.00	5.00	.40	51.47
Griffith	29.70	18.00	5.00	5.00	.00	51.00
W. J. Maxwell	29.70	18.00	5.00	5.00	.00	50.73
W. Richardson	29.70	18.00	5.00	5.00	.50	50.40
N. King	29.70	18.00	5.00	5.00	1.00	50.40
F. L. W.	29.70	18.00	5.00	5.00	1.04	50.35
N. P. S.	29.70	18.00	5.00	5.00	.00	50.30
D. D. Fitzgerald	29.70	18.00	5.00	5.00	1.00	50.04
C. Drake	29.70	18.00	5.00	5.00	.00	49.96
W. J. S.	29.70	18.00	5.00	5.00	1.00	49.80
L. F. S.	29.70	18.00	5.00	5.00	.40	49.85
S. H. H.	29.70	18.00	5.00	5.00	1.00	49.74
S. B. H.	29.70	18.00	5.00	5.00	.00	49.25
M. F.	29.70	18.00	5.00	5.00	1.00	49.10
W. J. S.	29.70	18.00	5.00	5.00	.00	48.92
H. H.	29.70	18.00	5.00	5.00	1.00	48.17
Members	29.70	18.00	5.00	5.00	1.00	48.04

CADET-MIDSHIPMEN.

Deficient sections of fourth class (31 members).

The following Cadets, having been turned back at the semi-annual examination, have no relative position with the members of the fourth class:

† Arnold, J. P.	† Cockle, R. R.	† Jones, Richard.
† Bailey, J. B.	† Cooke, P. B.	† Kimball, E. F.
† Berkely, F. L.	† Cooper, R. J.	† Leiper, E. F.
† Biddle, J. C.	† Franklin, T. B.	§ Levisce, Leonidas.
† Bliss, Herbert.	§ Gilmore, A. C.	† O'Connell, James.
† Boufils, T. L.	† Gresham, W. A.	§ Ord, E. O. C.
§ Booth, H. D.	† Haines, H. C.	† Porter, J. P.
† Bowdon, F. W.	† Huntoon, F. A.	† Rodman, Hugh.
§ Breckinridge, R. J.	† Irving, Washington.	† Starkloff, E. A. Von.
† Brown, J. S.	† Jackson, S. L.	† Thompson, E. C.
† Bullitt, H. H.		

CADET-ENGINEERS.

*Merit-roll of the first class (3 members), annual examination, June, 1876, and general merit-roll for two years.**

Order of general merit.	Name.	Steam-engineering.	Electricity.	Chemistry and heat.	Applied mathematics.	French.	Conduct.	Aggregate for second year.	Aggregate for first year.	General aggregate for two years.
	Maxima for this class and year.....	198	45	144	120	45	150	702	355	1057
1	William B. Dunning	132.00	15.00	144.00	40.00	30.00	136.65	497.65	335.47	833.12
2	Henry H. Silvers	198.00	45.00	48.00	120.00	45.00	137.10	593.10	153.30	746.40
3	Robert I. Reid	66.00	30.00	48.00	40.00	15.00	138.60	161.60	968.43	430.93

* For the method used in forming this merit-roll see the Register for 1874-75.

CADET-ENGINEERS.

Merit-roll of third class (17 members), annual examination, June, 1876.

Order of annual merit.	Name.	Mathematics.	Chemistry.	History, composition, and rhetoric.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	72	32	24	16	8		152
*1	Ira N. Hollis	72.18	30.08	21.42	12.84	7.70	1.23	142.93
*2	Franklin J. Schell	70.20	29.44	21.00	13.00	6.02	0.81	138.45
*3	Harry W. Spangler	70.74	28.00	20.16	12.20	6.24	1.00	136.34
*4	Gould H. Bull	65.52	27.92	19.68	12.76	6.92	1.65	131.13
5	George W. McElroy	61.38	24.24	17.52	11.00	6.56	1.70	119.60
6	Frank W. Bartlett	54.36	24.72	19.68	12.60	6.52	1.50	116.28
7	Robert S. Griffin	55.62	23.92	17.82	12.20	6.30	0.73	115.13
8	Howard Gage	51.48	25.60	18.96	11.40	6.34	1.54	112.64
9	Frederic C. Bieg	51.84	23.04	18.06	12.60	6.38	0.73	111.23
10	John L. Gow	52.74	23.92	18.12	10.92	5.98	0.95	110.23
11	Joseph R. Wilmer	49.32	22.96	19.74	12.40	5.82	0.69	109.55
12	Mortimer E. Cooley	48.96	24.96	16.56	11.44	6.74	1.08	107.52
13	Henry K. Ivers	45.72	23.04	18.66	10.84	6.66	0.86	104.66
14	Charles L. Wight	47.70	23.68	17.04	10.40	6.76	1.56	104.02
15	George E. Burd	46.08	23.20	16.98	11.40	6.10	0.84	102.92
†	Horace G. Dungan	46.62	22.32	15.84	9.48	5.92	1.18	99.99
†	Joseph McC. Pickrell	44.64	22.00	16.14	10.88	5.90	0.81	97.29

CADET-ENGINEERS.

Merit-roll of fourth class (30 members), annual examination, June, 1876.

Order of annual merit.	Name.	Mathematics.	French.	History and composition.	Drawing.	Conduct.	Aggregate.
		36	8	24	8		76
1	Richard Gatewood	34.29	6.94	21.60	6.30	0.28	68.85
2	W. M. McFarland	33.03	6.84	21.06	6.12	0.25	66.80
3	M. D. Noell	32.22	5.76	20.04	6.64	0.57	64.09
4	P. T. Bowles	30.24	6.14	20.04	6.56	0.22	62.76
5	F. M. Bennett	29.97	5.40	20.22	6.38	0.87	61.10
6	A. M. Hunt	28.17	6.10	19.20	6.64	0.38	59.71
7	J. W. Annan	27.72	6.10	19.50	6.28	0.50	59.08
8	R. C. Bryan	29.61	5.68	17.76	6.28	0.37	58.96
9	H. S. Elsdorfer	28.80	5.86	18.18	6.72	0.67	58.95
10	C. B. Lubbe	29.16	5.39	17.76	6.18	0.36	54.70
11	H. F. Harrison	27.36	5.54	18.90	6.20	0.36	57.64
12	H. P. Norton	27.36	5.50	17.52	7.12	0.32	57.18
13	E. H. Scribner	27.90	5.90	16.80	6.84	0.42	57.02
14	G. R. Salisbury	29.16	5.14	16.68	6.24	0.23	56.99
15	C. A. Carr	27.09	5.60	18.48	5.76	0.20	56.73
16	E. O. C. Acker	26.46	4.66	19.08	6.66	0.21	56.65
17	T. J. Hogan	25.92	5.42	18.06	7.00	0.44	55.96
18	J. U. Crygier	26.19	4.44	17.94	6.56	0.63	54.50
19	F. La M. Bartholow	25.56	5.14	17.64	5.90	0.28	53.96
20	J. H. Yarnall	24.03	6.66	17.76	5.82	0.33	53.94
21	C. G. Talcott	25.92	5.04	15.96	6.74	0.45	53.21
22	D. L. Mercier	25.74	4.70	17.46	6.06	0.83	53.13
23	Martin Devington	25.02	5.02	17.10	6.20	0.46	52.88
24	J. H. Baker	23.94	5.42	16.92	6.12	0.30	52.10
25	F. C. Bowers	24.03	5.78	16.56	5.84	0.38	51.83
26	R. T. Isbester	23.94	5.08	17.34	6.08	1.05	51.39
27	T. F. Carter	23.13	4.70	16.02	6.22	0.16	49.91
28	William S. Smith	24.30	5.06	15.00	5.86	0.51	49.71
29	C. A. Miller	21.42	4.74	15.48	5.82	0.80	46.66
30	A. W. Temple	a	a	a	a	a	.....

REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

I. The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; and ten appointed annually at large.

II. The nomination of candidates for admission from the District of Columbia and at large is made by the President. The nomination of a candidate from any congressional district or Territory is made on the recommendation of the Member or Delegate from actual residents of his district or Territory.

III. Each year, as soon after the 5th of March as possible, Members and Delegates will be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress.

IV. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 21st of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the June examination, will be examined on the 12th of September following; and should any candidate fail to report, or be found physically or mentally disqualified for admission, in June, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined on the 12th of September following. When any of the dates assigned for examinations fall on Sunday the examination will take place on the following Monday.

V. A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting nominations and attempting to enter a service for which they are not fitted.

EXAMINATION.

VI. Each candidate for appointment as Cadet-Midshipman must present to the Academic Board satisfactory testimonials of good moral character, and must certify as *honorable* to his precise age, which must be over fourteen and less than eighteen years at the time of the examination. No candidate will be examined whose age does not fall within the prescribed limits.

VII. Candidates must be physically sound, well formed, and of robust constitution; they will be required to pass a satisfactory examination before a medical board com-

used of the surgeon of the Naval Academy, and two other medical officers to be designated by the Secretary of the Navy.

VIII. Any *one* of the following conditions will be sufficient to cause the rejection of a candidate :

- Feeble constitution, inherited or acquired ;
- Greatly-retarded development ;
- Permanently-impaired general health ;
- Decided cachexia, diathesis, or predisposition ;
- All chronic diseases or results of injuries that would permanently impair efficiency,

viz :

- Weak or disordered intellect ;
- Contagious and communicable diseases ;
- Unnatural curvature of spine, torticollis, or other deformity ;
- Permanent inefficiency of either of the extremities or articulations from any cause ;
- Epilepsy or other convulsions within five years ;
- Impaired vision, or chronic disease of the organs of vision ;
- Great hardness of hearing, or chronic disease of the ears ;
- Chronic nasal catarrh, ozæna, polypi, or great enlargement of the tonsils ;
- Impediment of speech to such an extent as to impair efficiency in the performance of duty ;
- Decided indications of liability to pulmonary disease ;
- Chronic cardiac affections ;
- Hernia or retention of testes in inguinal cavity ;
- Sarcocoele, hydrocele, stricture, fistula, or hæmorrhoids ;
- Large varicose veins of lower limbs, scrotum, or cord ;
- Chronic ulcers.

Attention will also be paid to the stature of the candidate ; and no one *manifestly* under size for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates who fall below the standard will receive a second and final examination in the subjects in which they fail. Deficiency in any one of the subjects at the second examination will be sufficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have the privilege of another examination for admission to the same class unless recommended by the Board of Examiners."—*Reg. Stat.*, § 1515.

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and notation.*—The candidate is required to express in figures any whole number, decimal, or mixed number ; to write in words any given number ; and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money ; addition, subtraction, multiplication, and division of denominate numbers ; the relation existing between the troy and avoirdupois pound ; number of cubic inches in a gallon ; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such pro-

cesses, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetics.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school arithmetics. It is essential that the candidate shall be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance (attention is specially called to the rivers and bodies of water on which cities are situated); the course of a vessel in making a voyage between well-known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as treated in the common school text-books, embracing the following subjects: The divisions of letters, and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for *comparing adjectives*; irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives, secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as, the difference between *my* and *mine*, between *thou* and *you*, and the various uses of *it*; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs*; the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflexion of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense-endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs*; conjunctive adverbs; the use of *prepositions*, *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under syntax.

Parsing, according to the following model:

Noun : Class, gender, number, person, case.

Article : Definite or indefinite; qualified noun.

Adjective : Class, compared or not compared; comparison, if admitting it; degree of comparison; qualified noun.

Personal pronoun : Person, gender, number, case.

Relative pronoun : Person, gender, number, case, antecedent.

Interrogative pronoun : Gender, number, case.

Adjective pronoun (or pronominal adjective): Class; qualified word.

Verb : Class, form, principal parts, tense, mood, voice, person, number, subject.

Adverb : Class; derivation and comparison, if derived and compared; qualified word.

Preposition : Words between which the relation is shown by the preposition.

Interjection : The kind of emotion expressed.

Conjunction : Class; words or sentences connected.

The construction of the word will be required in all cases.

READING.—Candidates will be examined in reading aloud English prose, in a standard work; for example, Bancroft's History of the United States.

WRITING AND SPELLING.—Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use.

An exercise containing eight or more mistakes in spelling will not be considered satisfactory, and will be sufficient of itself to cause the rejection of the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations will receive appointments as Cadet-Midshipmen, and become inmates of the Academy. Each cadet will be required to sign articles by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy), unless sooner discharged. The pay of a Cadet-Midshipman is \$500 a year, commencing at the date of his admission.

XIV. Cadets immediately after their admission will supply themselves with the following articles, viz:

One parade-suit.....	\$37 72	One hair-mattress	\$3 45
One undress-suit	15 79	One straw-mattress	1 35
One working-suit	2 95	One hair-pillow	1 22
One overcoat	22 50	One pair blankets.....	4 03
One rubber-coat	5 35	Two bed-spreads.....	2 36
One parade-cap	3 95	Six sheets	4 71
One undress-cap	1 65	Four pillow-cases.....	1 24
* Two pairs high shoes	12 50	* One tooth-brush.....	25
One pair gymnastic slippers	95	* One hair-brush	50
* Eight white shirts.....	14 55	* One whisk	27
* Two night-shirts	2 60	* One coarse comb.....	25
* Four under-shirts	2 52	* One fine comb.....	30
Twelve linen collars.....	1 65	One mug	13
* Eight pairs socks.....	2 00	* One cake soap.....	10
* Four pairs drawers	2 64	One soap-dish	13
* Six handkerchiefs	1 62	One requisition-book	30
* Eight towels	2 00	One laundry-book	30
Two pairs drill-gloves.....	1 32	One pass-book	30
Two pairs Lisle-thread gloves	55	One stencil and ink	23
* One pair suspenders	42	* One thread and needle case	53
One neck-tie.....	42	One rug	1 71
Two clothes-bags	62	One wash-basin and pitcher	1 30

Room-mates will procure for their common use—

One looking-glass (half-cost).....	\$0 66	One broom (half-cost).....	\$0 18
One water-pail (half-cost).....	49	One table-cover (half-cost).....	63
One slop-bucket (half-cost).....	49		
Total			169 70

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home; but all other articles must conform to the regulations, and must therefore be supplied by the storekeeper.

X. Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of \$50, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, in the purchase of text-books, and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of \$50 must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing.....	\$169 70
Deposit for books, &c.....	50 00
Total deposit required.....	219 70

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XV. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling-expenses.

GEO. M. ROBESON,

Secretary of the Navy.

AMINATION OF CANDIDATES FOR ADMISSION AS CADET-MIDSHIPMEN,
JUNE AND SEPTEMBER, 1876.

ARITHMETIC.

SEPTEMBER, 1876.—Time allowed, *five hours*.

Two questions may be omitted.

1. Express 6749 *thousandths* and 337 *millionths* as decimals, and find the quotient of the first by the second.

Reduce $\left(\frac{3}{25} \text{ of } 2.45 - \frac{1}{100} \text{ of } .02\right) - 1000$ to a decimal.

Which is the greatest and which the least of the expressions, $\frac{1}{2} + \frac{1}{3}$, 1.41421, and $\frac{1}{2} + \frac{1}{4}$?

What decimal part is .7409375 of 237100?

2. By what fraction must $\frac{1\frac{1}{2}}{1\frac{1}{2}}$ of $\frac{2}{3} + \frac{2\frac{1}{2} - 1\frac{5}{8}}{\frac{1}{2} + 1\frac{3}{8}} - \frac{8\frac{1}{2}}{7\frac{2}{3}}$ be *divided*, that the quotient may be $\frac{1}{2}$?

The factors of a certain number are $\frac{1}{12}$, $2\frac{3}{4}$, $\frac{1}{4}$, and $5\frac{1}{2}$. What is $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{2}$ of this number?

The sum of two fractions is $\frac{11\frac{1}{2}}{25}$, and their difference is $\frac{1}{10}$. Find the fractions.

3. Reduce $\frac{1}{2}$ of 16s. 4d. to the decimal of £1.

One kilometre = 1000 metres = $\frac{5}{8}$ of a mile. Reduce 17 miles 6 furlongs 82 yards 4 feet to metres.

Find the value of 27 yards 2 feet 9 inches of gold lace, $\frac{2}{3}$ of an inch wide, if 17 yards foot 11 inches of lace, 1 inch wide, cost \$25.40.

4. One-third of *A's* money is equal to two-fifths of *B's*, and *A* has \$17.50 more than *B*; how much money has each?

A and *B* run a race, their rates of running being as 17 to 18; *A* runs $2\frac{1}{2}$ miles in 16 minutes 48 seconds, and *B* runs the whole distance in 34 minutes. What was the distance run?

5. What is the present worth of \$5747, due 9 months hence, interest at $3\frac{1}{2}$ per cent.?

A vessel is worth \$96084; for what sum must her owner insure her, so that, if she is lost, he may receive both the value of the vessel and the sum paid for insuring her, the rate of insurance being $1\frac{1}{2}$ per cent.?

6. Extract the square root of 900780169, and find the value of $\frac{\sqrt{2} - 1}{\sqrt{2} + 1}$ to four decimal places.

7. A contractor undertook to complete a piece of work in 84 days, and engaged 30 men to do it; after 40 days, he put on 20 more men, and then finished the work 2 days sooner. How many days behindhand would he have been if he had not engaged the additional men?

8. The walls of a room are to be papered; the room is 23 feet 8 inches long, 15 feet 6 inches wide, and 11 feet 9 inches high; there are two windows, each 9 feet 6 inches high and 5 feet wide; a fire-place, 4 feet 6 inches high and 6 feet wide; and a door, 7 feet 6 inches high, 3 feet 6 inches wide. Find the cost of the paper required, at \$4.08 per roll of 12 yards, the paper being 26 inches wide.

9. Two trains, 92 feet and 84 feet in length respectively, are moving on parallel rails in opposite directions, and are observed to pass each other in one second and a half;

but when they are moving in the same direction, the velocities being the same before, the faster train is observed to pass the other in six seconds. Find the rate miles per hour at which each train travels.

10. On a piece of work 3 men and 5 boys are employed, who do $\frac{1}{2}$ of it in 5 days after this, 1 more man and 5 more boys are put on, and the work is completed in 3 days more. How long would it take a man to do the whole work alone, and how long would it take a boy?

ENGLISH BRANCHES.

JUNE 23, 1876.—Time allowed, three hours.

GRAMMAR.

1. "To live with them is far less sweet than to remember thee." Analyze.
2. Name the three cases, and explain the different uses of each.
3. What part of speech is *that* in each of the following sentences?
I know *that* you are right.
The good *that* I would, I do not.
Do you dare tell me *that*?
4. Give the possessive plural of *box, enemy, journey, wreath*.
Give the past participle of *lay, die, thrust*.
5. "But *how* can he expect *that* others should
Build for him, sow for him, and at his call
Love him, *who* for himself will take no heed at all?"
Parse the words in Italics.

GEOGRAPHY.

1. State where, and on what water, the following cities are situated: 1. Glasgow 2. Trieste; 3. Calcutta; 4. Petersburg.
2. Describe the following rivers, telling where they rise, in what direction the flow, into what water they empty: 1. Mohawk; 2. Congo; 3. Brahmaputra; 4. Humber.
3. Where is Cape Wrath? Cape Matapan? Cape Gallinas? Cape Palmas?
4. Fix the position and direction of the following: 1. Grampian Hills; 2. Carpathian Mountains; 3. Green Mountains.
5. Make a coasting voyage between Portland, Me., and New Orleans, stopping at six seaports. State in order the bodies of water passed through, the position of the cities visited, and the names of the States passed.

SPELLING.

Scientific.	Disrespect.	Incessant.	Campaign.
Supremacy.	Caprice.	Proceed.	Subterranean.
Economy.	Galley.	Supersede.	Intrepid.
Stratagem.	Grenadier.	Quarrel.	Parascology.
Clerical.	Forage.	Artificer.	Quarantine.
Acquiesce.	Equivalent.	Exhaustion.	Permanent.

RE-EXAMINATIONS.

ARITHMETIC.

SEPTEMBER, 1876.—Time allowed, five hours.

Two questions may be omitted.

1. Simplify each of the expressions: $\frac{.0075 \times 2.1}{.0175}$, $\frac{4.255 \times .0064}{.00032}$, $\frac{5\frac{1}{2}}{7\frac{1}{2}}$ of $\frac{21.25}{.046575}$,
 $\frac{91.31 + .0298}{.1 - .092574}$

Divide 10.01 by .00091 and .00031 by 10.01, and multiply the two quotients together.

2. How many times is the difference between the product and sum of $7\frac{1}{2}$ and $4\frac{3}{4}$ contained in $\frac{1}{5}$ of $\frac{2}{3}$ of $\frac{25}{28}$ of $\frac{7}{10}$ + $\frac{1}{8}$ of $\frac{8}{3}$ of $7\frac{1}{5}$ + $16\frac{1}{60}$?

Reduce to its simplest form—

$$\frac{5\frac{1}{2} + 5\frac{1}{2}}{5\frac{1}{2} - 5\frac{1}{2}} \div \frac{\left(4\frac{1}{2} - \frac{55}{12}\right) \text{ of } \frac{24}{33}}{4\frac{1}{2} + \frac{55}{12} \text{ of } \frac{24}{33}}$$

Given that the sum of the divisor and quotient is 33600, also that the quotient is 15 times the divisor, and the remainder is $\frac{1}{15}$ of the divisor; find the dividend.

3. Reduce $\frac{3\frac{1}{2}}{1\frac{1}{2}}$ of $\left\{ \frac{19}{20} \text{ of } £1 - \frac{7}{45} \text{ of } 1s. \right\}$ to the fraction of £9 16s. 1d.

How many gallons of water will it take to cover an acre of ground to the depth of one inch?

4. *A* can do in 2 days as much work as *B* in 3 days, and *B* in 5 days as much work as *C* in 4 days; what time will *C* require to finish a piece of work which *A* can do in 9 days?

Divide \$100 between two persons so that one may have $\frac{7}{9}$ as much as the other.

5. A man bought a horse for \$365, giving his note due in 30 days; he sold the horse at once, taking in payment a note for \$435, due in 4 months; what was his gain per cent.? (Interest at 6 per cent. per annum.)

In what time will the interest on £57 1s. 8d. amount to £2 11s. 4½d. at 7½ per cent. per annum?

6. Which is the greater, the square root of 231, or the cube root of 4711?

7. A contractor engages what he considers a sufficient number of men to do a piece of work in 84 days; but he ascertains that 3 of his men do respectively $\frac{1}{6}$, $\frac{1}{7}$, and $\frac{1}{9}$

less than an average day's work, and two others $\frac{1}{8}$ and $\frac{1}{10}$ more; in order to complete the work in the given time, he procures the help of 17 additional men for the 84th day. How much less or more than an average day's work on the part of these 17 men is required?

8. The floor of a hall is 260 feet long and 93 feet wide; find the cost of covering it with carpet and oil-cloth; the oil-cloth to be laid along the sides and ends a yard wide, and the carpet to extend 6 inches over the oil-cloth; carpet, \$2.09 a yard, 33 inches wide; oil-cloth, 90 cents a square yard.

9. A man can walk from *A* to *B* in 1 hour less than a second man, and, when they start from opposite ends of the distance and walk in contrary directions, they meet at a point which is twice as far from *A* as it is from *B*; if the first man walks 5 miles per hour, what is the distance between *A* and *B*?

10. A train leaves *B* at 9 a.m. and runs to *C* at the rate of 15 miles an hour; and another train leaves *A* at noon, and, running through *B* to *C* at 25 miles an hour, reaches *C* half an hour later than the train from *B*. Find the distance from *A* to *C*, the distance from *A* to *B* being 15 miles.

ENGLISH BRANCHES.

JUNE 24, 1876.—Time allowed, three hours.

GRAMMAR.

1. Give the possessive, singular and plural, of *ally*, *alley*, *spray*, *grief*, *leaf*, *loss*.

2. Explain the difference between the active and the passive voice. Explain transitive and intransitive verbs, and show how the distinction of voice applies in the two classes.

3. Name the relative pronouns, and state to what class of objects each of them is applied.

4. Give the principal parts of *fly, flee, weave, fight, drown, burst*.

5. Analyze the following sentence, and name the parts of speech:

"That man has been from time immemorial a right-handed animal, is beyond dispute."

GEOGRAPHY.

1. Fix the position of the following cities, and tell which of them are capital States: 1. Galveston; 2. Bangkok; 3. Columbus; 4. Hamburg; 5. Melbourne.

2. State what bodies of water are connected, and what bodies of land separated the following: 1. Torres Strait; 2. Strait of Sunda; 3. Niagara River; 4. St. George Channel; 5. Strait of Ormuz.

3. Bound Nevada. Name the Territories of the United States.

4. Give the source, direction, and mouth of the Wabash River; Gila River; Do River; Oder River.

5. Make a voyage from Matanzas to Constantinople.

SPELLING.

Eligible.	Principally.	Talisman.	Allegiance.
Colleague.	Privilege.	Scrutiny.	Skirmisher.
Business.	Reckoned.	Malice.	Feigning.
Efficient.	Frivolous.	Countenance.	Tenable.
Apostle.	Malediction.	Integer.	Treachery.
Government.	Colloquy.	Foreigner.	Cement.

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

In pursuance of law, applications will be received by the Navy Department for appointment of Cadet-Engineers.

The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the registry.

The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

I. The number of appointments which can be made is limited by law to twenty each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 5th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four academic years, with two additional years at sea. All cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer is the same as that of a Junior Midshipman, \$500 per annum, and at sea the same as Midshipmen.

V. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the second degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition; and geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those for the admission of Cadet-Midshipmen.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1876.

ARITHMETIC.

Time allowed, two and a half hours.

Algebraic solutions not admitted.

1. Find the value to six places of decimals of the series,

$$\frac{2}{5} + \frac{4}{5 \cdot 10} + \frac{8}{5 \cdot 10 \cdot 15} + \frac{16}{5 \cdot 10 \cdot 15 \cdot 20} + \&c.$$

Express .144230769 as a common fraction, and reduce to a decimal

$$\frac{.0759}{2\frac{1}{2} - \frac{3}{4}} \div \frac{3\frac{1}{3} - \frac{1}{2}}{14.75}.$$

2. Simplify the expression:

$$\frac{\frac{3}{5} \text{ of } (\frac{5}{4} - \frac{3}{4})}{\frac{1}{5} \text{ of } (\frac{3}{4} - \frac{1}{4})} \text{ of } \left\{ \frac{\frac{5}{13} - \frac{1}{13}}{\frac{5}{13} - \frac{1}{13}} - \frac{9\frac{1}{2} + 3\frac{1}{2}}{\frac{1}{14} + \frac{1}{7\frac{1}{2}}} + \frac{7\frac{5}{8} - 4\frac{7}{8}}{\frac{3}{8} - \frac{1}{11}} \right\}$$

3. Find the value of the expression $\frac{\sqrt{23}-4}{\sqrt{23}+4} + \frac{10-\sqrt{23}}{10+\sqrt{23}}$ to two decimal places

Express the cube root of .00448 as a decimal of the cube root of .0875.

4. A grocer has a pair of false scales, such that a parcel which weighs 49 lbs. on one scale weighs 64 lbs. in the other. If he uses these scales in buying and selling the way most advantageous to himself, what per cent. does he make on an article which he buys at 15 cents per lb. and sells at 18 cents? What does he make on the same article when he uses the false scales for selling only?

5. A sold a vessel worth \$40000 to B at a certain loss per cent. B sold her to C the same losing rate, and C sold her for \$36750, by which he made 20 per cent. on his purchase. What per cent. did A and B each lose?

ALGEBRA.

Time allowed, three hours.

1. Solve the equations:

$$\frac{3x+3}{16} + \frac{7x-4}{15} - \frac{7x+1}{20} = 2; \quad a+x+\sqrt{a^2+6x+x^2}=b;$$

$$\text{and } \frac{17}{6x-17} - \frac{10}{3x-10} = \frac{1}{1-2x}.$$

2. Solve the equations:

$$\left. \begin{array}{l} 101x-24y=63 \\ 103x-28y=29 \end{array} \right\}; \quad \left. \begin{array}{l} x+y+z=36 \\ 5x-2y=80 \\ 7x-9z=86 \end{array} \right\}; \quad \text{and } \left\{ \begin{array}{l} ax+by=c \\ mx-ny=d \end{array} \right\};$$

3. Find the greatest common divisor of x^4-41x^2+16 and $x^4-7x^2+28x-16$.

Reduce the fraction $\frac{56x^3-28x^2-42x+14}{42x^2-28x-14}$ to its lowest terms.

Find the least common multiple of $a^4 - 10a^2 + 9$, $a^4 + 10a^3 + 20a^2 - 10a - 21$, and $-4a^3 - 22a^2 - 4a + 21$.

A and B run a race of a yards: first A gives B a start of b yards and beats him c seconds; then A gives B a start of d seconds and is beaten by e yards: find time in which A and B can each run a mile. Verify the result, making the following substitutions: $a, 1760$; $b, 44$; $c, 51$; $d, 75$; $e, 52$.

A person starts to walk at a uniform speed, without stopping, from A to B and C , at the same time that another starts to walk at a uniform speed, without stopping, from B to A and back; they meet a mile and a half from B , and again, an hour later, a mile from A : find the rates of walking and the distance between A and B .

GEOMETRY.

Time allowed, two hours.

Prove that, if through a fixed point within a circle any chord be drawn, the product of its two segments will have the same value, whatever be the direction of the chord. What is the *least* chord that can be so drawn? the *greatest*?

What is meant by a *mean proportional*? Prove that if through a fixed point within a circle, a tangent to the circle be drawn, and also any secant, the tangent is a mean proportional between the whole secant and its external segment.

Prove that the square described upon the hypotenuse of a right triangle is equivalent to the sum of the squares described upon the other two sides.

Prove that the side of a regular hexagon is equal to the radius of the circumscribed circle. Denoting the radius of the circle by a , find an expression for the length of a side of the inscribed equilateral triangle, and also for the area of the triangle.

If, at any point D in the side AC of the triangle ABC , a straight line DE be drawn making an angle ADE equal to the angle ABC , and meeting AB in E , prove that if DB and EC be drawn, the angle ADB is equal to the angle AEC .

NATURAL PHILOSOPHY.

Time allowed, three hours.

1. How are forces measured? What is the *moment* of a force? Define *weight*, *mass*, and *specific gravity*.

At what part of the earth's surface is the weight of a body, as determined by a ring-balance, the greatest, and why?

2. Define *centre of gravity*: also stable, unstable, and neutral equilibrium.

The distance of the centre of gravity of a cone from its base is equal to one-fourth of its altitude.

Find the position of the centre of gravity of a body formed of two cones (altitudes a and b) having a common base, the vertices being on opposite sides of the base.

3. Show that a board cut in the form of a rhombus is always in stable equilibrium when resting on its edge on a horizontal plane.

A conical sugar-loaf whose height is twice the diameter of its base stands on a table sufficiently rough to prevent it from sliding: if the table be tilted until the sugar-loaf is on the point of toppling over, find the inclination of the table to the horizon.

4. The *wheel and axle* being in equilibrium, find the relation between the power and the weight.

Two wheels are connected by a rough endless rope: the diameter of the larger wheel being four times that of the smaller, find the ratio of the axles in order that equal weights suspended from cords wound round the axles in contrary directions may produce equilibrium.

5. What kind of velocity is produced by the action of a constant force?

Give the three laws of motion.

Find the space described by a falling body during the third second of its motion.

6. How is the pressure of a fluid upon any point of the containing vessel determined?

A pipe carries the rain-water from the top of a house to a tank, from which surplus water escapes by means of a valve in the top; it is found that a weight of 20 lbs. placed on the valve causes the water to rise in the pipe to the height of 20 ft. Find the area of the valve.

7. Sketch a common hydrometer.

If the volume between two successive graduations on the stem of a hydrometer be one thousandth part of its whole bulk, and it float in distilled water with 20 divisions, and in sea-water with 46 divisions above the surface, find the specific gravity of sea-water.

The cavity in a conical rifle-bullet is filled with a plug of pine wood. If the bullet be held in the hand beneath the surface of water, and the plug be then removed, the apparent weight of the bullet be increased or diminished?

8. How may the height of a mountain be ascertained roughly by means of a thermometer?

If the difference of readings of a thermometer which is graduated according to Fahrenheit's and the centigrade scale be 40, find the temperature by each scale.

ENGLISH BRANCHES.

Time allowed, three hours.

SPELLING.

Judicious.	Effective.	Conscience.	Artillery.
Conception.	Manifest.	Apprehension.	Military.
Phrase.	Specific.	Acuteness.	Sluggish.
Atmospheric.	Typical.	Process.	Resources.
Relevant.	Precise.	Edifice.	Catastrophe.
Anomaly.	Nursery.	Analysis.	Civil.

GEOGRAPHY.

1. Where is Cheyenne? Cayenne? Sydney? Stettin? Sheffield? Tell which, if any, are capitals of States.

2. Give the position and direction of the Pyrenees Mountains; Ural Mountains; Himalayas; Alleghany Mountains. Tell what States are bounded by each of these ranges.

3. Name in order the States of South America that border on the sea-coast, and mention three seaports in these States, giving the position of each.

4. Give the source, direction, and mouth of the Roanoke River; St. Clair River; Rhone; of any two rivers of France.

5. Make a voyage from Buenos Ayres to Bombay via the Suez Canal, and stop at three seaports on the way. Name in order the waters passed through, and fix the position of the ports.

ENGLISH GRAMMAR.

1. Give the possessive singular and objective plural of *canopy*, *knife*, *chimney*, *child*.
2. State the voice, mood, tense, person, number, and principal parts of each of the following verbs:

1. You *should be overthrown*.
2. I *am sleeping*.
3. One on earth in silence wrought.
4. A shell burst near them.

3. What is a demonstrative pronoun? an impersonal verb? a conjunctive adverb? What is the object of the inflexion of nouns?

4. Analyze the following sentence:

"But you, who know me better, know that I am something more than the man I would imply."

5. Parse the words in italics:

"Some have gone on long travel, into distant lands, unarmed, valiantly bearing the sacred symbol into heathen countries."

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.*—Description of all kinds of rope, and its practical manipulation for all purposes on shipboard; measuring for and fitting standing and running rigging; mast, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seaman's Handbook, with lectures, and illustrations from models.

NAVAL CONSTRUCTION.

Text-books.—Thearle's Naval Architecture and Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and manœuvring of a fleet, under steam or sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

NAVAL TACTICS.*—Exercises in boats under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal Code.

The instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial, remaining, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.*—Organization and formation of squad, company, and battalion; school of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet exercise.

Text-books.—United States Infantry Tactics; Wingate's Rifle Practice.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States ship Santee.

MORTAR-PRACTICE.

FENCING.—Exercise with small-swords and broad-swords.

* Cadet-Midshipmen only.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and surd quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the application of the method, particularly to the projections of the sphere and the construction of maps.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections; Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display marked ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1876-77:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with applications to trigonometry and geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and Schools; Todhunter's Theory of Equations; Rice and Johnson's Elements of the Differential and Integral Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and details of marine steam-engines, and of instruments and apparatus used in connection with them; the principles followed to insure strength in construction; the computation of the power and its cost; the duties of the engine-room watch, and of the engineer division.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, and the processes of manufacture.

DESIGNING OF MACHINERY.*—The designing and construction of engines and other machinery, and the motions employed in valve-gearing.

MECHANICAL DRAWING.*—The nomenclature of design and construction; general and conventional practices of the art; the execution of plans, elevations, and sections.

PRACTICAL EXERCISES.—The management of marine steam-apparatus; [the use of tools and machines; hand-work of the machine-shop, pattern-shop, smithery, boiler-shop, and foundry.]*

Text-books.—King's Practical Notes on the Steam-Engine; Bourne's Hand-Book of the Steam-Engine; Warren's Elements of Mechanical Drawing; Willis's Principles of Mechanism; Rankine's Steam-Engine and other Prime Movers; Zeuner's Valve-Motion.

*Cadet Engineers only.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments, especially those used for determining terrestrial latitudes and longitudes.

Text-book.—C. J. White's *Astronomy*.

NAVIGATION.*—Theory and practice of navigation, the latter including instruction in the duties of the navigator, the use of navigating-instruments, and their construction, with the solution of problems and the use of tables.

Text-books.—Coffin's *Navigation*; Merrifield's *Deviation of the Compass*.

SURVEYING.*—The form of the earth, with special reference to the construction of charts; explanation of geodetical surveys; the solution of problems in nautical surveying; and practical work in surveying and constructing charts.

Text-book.—Jeffers's *Marine Surveying*.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum-analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

CHEMISTRY.—General chemistry.

METEOROLOGY AND CLIMATOLOGY.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; sensible and insensible caloric; effects of heat; instruments used for the measurement of heat; thermo-dynamics.

Text-books.—Stewart's *Elementary Physics*; Eliot and Storer's *Chemical Analysis*; Jenkin's *Magnetism and Electricity*; Stewart's *Elementary Treatise on Heat*; Miller's *Inorganic Chemistry*.

Reference-books.—Ganot's *Physics*; Maxwell's *Theory of Heat*.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima and the tracing of curves; the methods of integration, and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work, and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriiform fluids.*—Laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

THE STRENGTH AND RESISTANCE OF MATERIALS.†—Strength and flexure of beams; beams of uniform resistance; results obtained by experimentors.

* Cadet-Midshipmen only. † Cadet-Engineers only.

Text-books.—Rice and Johnson's Elements of the Differential and Integral Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; and Wood's Treatise on the Resistance of Materials.

ELECTIVE COURSE.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in integral calculus and analytical mechanics.

Text-book.—Williamson's Integral Calculus.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.

International law :—origin and growth of the science; rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; extradition; duties of ministers, consuls, and naval commanders; confiscation of an enemy's property and debts; embargoes; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii*; rights and duties of neutrals; law of contraband; law of blockade; right of search; ship's papers; truces, passports, and treaties of peace; offences against the law of nations; piracy; slave-trade.

Outlines of maritime law.

Lectures.

Text-book.—Woolsey's International Law.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1872; historical geography; progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's General Sketch of History, with Labberton's Historical Atlas; Eliot's History of the United States, with modern atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology; inflexional changes since the Conquest. Syntax; analysis of sentences.—Readings from classical authors, with applications of the principles of grammar, and exercises in analysis and in tracing the etymological meaning of words.—Classification of words; definition of words by usage and by derivation; synonyms; laws of change in the meaning of words by contraction, extension, and amelioration.—Faults in diction, and their remedies; selection and arrangement; elementary principles of reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Fasquelle's French Grammar; Duffet's Grammar; Howard's Aid to French Composition; Prud'homme's French Nautical Phrases; Erckmann-Chatrian's Le Conserit; Gase's Dictionary; Roget's Spanish Manual; Tolon's Reader.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are arranged in four classes, each class pursuing the course for the year.

PROGRAMME OF RECITATIONS FOR THE FIRST TERM.

From September 20, 1876, to January 27, 1877.

The time devoted to daily recitations is divided into three periods, indicated thus:—(1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m.

Practical exercises begin on Saturday at 10.45 a. m., and on all other days, except Sundays, at 4 p. m.

CADET-MIDSHIPMEN.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry. Elective Course once a week.
English Studies, History, and Law.....	M. T. W. Th. F. (1)	English and History.
Modern Languages	1st division, M. T. Th. (3)	French.
	2d division, M. W. F. (3)	
Drawing.....	1st division, W. F. (3)	Line-drawing.
	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1)	Trigonometry and Descriptive Geometry.
	F. (3)	Descriptive Geometry. Elective Course once a week.
English Studies, History, and Law.....	M. F. (2) W. (3)	History and Rhetoric.
Physics and Chemistry.....	T. W. Th. (2)	Elementary Physics.
Modern Languages	T. Th. (3)	French.
Drawing.....	M. (3) S. (1).....	Sketching.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	M. (3) F. (2) S. (1).....	Luce's Seamanship.
Ordnance and Gunnery.....	Th. (3)	Infantry Tactics.
Astronomy, Navigation, and Surveying.....	T. (3) W. Th. (2).....	Astronomy.
Mechanics and Applied Mathematics.....	M. T. W. Th. F. (1).....	Calculus. Elective Course twice a week.
English Studies, History, and Law.....	One period a month.....	Composition.
Modern Languages	M. T. (2) W. F. (3)	French.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	T. Th. F. (3).....	Naval Construction.
Ordnance and Gunnery.....	T. (2) W. (3).....	Ordnance and Armor.
Steam-Engineering.....	W. Th. (2) F. (1).....	Marine Engines.
Astronomy, Navigation, and Surveying.....	M. T. W. Th. (1).....	Navigation.
Physics and Chemistry.....	M. F. (2) S. (1).....	Heat and Light.
Modern Languages	M. (3)	Spanish.

CADET-ENGINEERS.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	M. T. W. Th. F. (2) S. (1).....	Algebra and Geometry. Elective Course once a week.
Steam-Engineering.....	1st division, W. F. (3).....	Mechanical Drawing
	2d division, T. Th. (3).....	
English Studies, History, and Law.....	M. T. W. Th. F. (1).....	English and History.
Modern Languages.....	1st division, M. T. Th. (3).....	French.
	2d division, M. W. F. (3).....	

CADET-ENGINEERS—Continued.

Department.	Periods.	Subjects.
THIRD CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1)	Trigonometry and Descriptive Geometry.
	F. (3)	Descriptive Geometry.
Steam Engineering	M. (3) S. (1)	Elective Course once a week.
Physics and Chemistry	T. W. Th. (2)	Mechanical Drawing.
English Studies, History, and Law	M. F. (2) W. (3)	Elementary Physics.
Modern Languages	T. Th. (3)	History and Rhetoric.
		French.
SECOND CLASS—THIRD YEAR.		
Steam Engineering	M. Th. (3) F. (2) S. (1)	Mechanical Drawing, Marine Engines, and Fabrication of Machinery.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
English Studies, History, and Law	One period a month *	Elective Course twice a week.
Modern Languages	M. T. (2) W. F. (3)	Composition.
		French.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	T. Th. F. (3)	Naval Construction.
Steam Engineering	M. T. W. Th. F. (1) W. (3)	Marine Engines, Fabrication and Designing of Machinery.
Physics and Chemistry	M. F. (2) S. (1)	Mechanical Drawing.
Mechanics and Applied Mathematics	T. W. Th. (3)	Heat and Light.
Modern Languages	M. (3)	Strength of Materials.
		Spanish.

* Theme Periods.—1. Sept. 23, S. (1), { C. M. Seamanship, } 2. Oct. 30, M. (1), Mechanics. 3. Nov. 27, M. (2), Modern Languages. 4. Dec. 27, W. (2), Navigation.

PROGRAMME OF RECITATIONS FOR THE SECOND TERM.

From January 29, 1877, to June 20, 1877.

CADET-MIDSHIPMEN.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
English Studies, History, and Law	M. T. W. Th. F. (1)	Elective Course once a week.
Modern Languages	1st division, M. T. Th. (3)	English and History.
	2d division, M. W. F. (3)	French.
Drawing	1st division, W. F. (3)	Topography.
	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1)	Analytical Geometry and Descriptive Geometry.
	M. (3)	Elective Course once a week.
Physics and Chemistry	T. Th. F. (2)	Descriptive Geometry.
English Studies, History, and Law	M. W. (2) S. (1)	Chemistry.
Modern Languages	T. W. Th. F. (3)	History and Rhetoric.
		French.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	T. Th. (3) F. (2)	Lucas's Seamanship.
	Th. (2)	Naval Tactics.
Ordnance and Gunnery	T. (2)	Ordnance Instructions.
Physics and Chemistry	M. W. (3) S. (1)	Physics.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Mechanics.
English Studies, History, and Law	One period a month †	Elective Course twice a week.
Modern Languages	M. W. F. (3)	Composition.
		Spanish.

* Theme Periods.—1. Sept. 21, S. (1), { C. M. Seamanship, } 2. Oct. 30, M. (1), Mechanics. 3. Nov. 27, M. (2), Modern Languages. 4. Dec. 27, W. (2), Navigation.

CADET-MIDSHIPMEN—Continued.

Department.	Periods.	Subjects.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	M. W. (2) S. (1).....	Lucas's Seamanship.
Ordnance and Gunnery.....	M. Th. (3) T. (1).....	Ordnance and Armour.
Steam-Engineering.....	W. F. (3) Th. (3).....	Marine Engines.
Astronomy, Navigation, and Surveying.....	M. W. Th. F. (1).....	Navigation and Surveying.
English Studies, History, and Law.....	T. F. (2).....	Public Law.
Modern Languages.....	T. (3).....	Spanish.

CADET-ENGINEERS.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	M. T. W. Th. F. (2) S. (1).....	Algebra and Geometry. Elective Course once a week.
Steam-Engineering.....	1st division, W. F. (3)..... 2d division, T. Th. (3).....	Mechanical Drawing.
English Studies, History, and Law.....	M. T. W. Th. F. (1).....	English and History.
Modern Languages.....	1st division, M. T. Th. (3)..... 2d division, M. W. F. (3).....	French.
THIRD CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1).....	Analytical Geometry and Descriptive Geometry. Elective Course once a week.
Physics and Chemistry.....	M. (3).....	Descriptive Geometry.
English Studies, History, and Law.....	T. Th. F. (2).....	Chemistry.
Modern Languages.....	M. W. (2) S. (1).....	History and Rhetoric.
	T. W. Th. F. (3).....	French.
SECOND CLASS—THIRD YEAR.		
Steam Engineering.....	T. Th. F. (2) T. Th. (3).....	Mechanical Drawing, Fabrication of Machinery, and Marine Engines.
Physics and Chemistry.....	M. W. (2) S. (1).....	Electricity.
Mechanics and Applied Mathematics.....	M. T. W. Th. F. (1).....	Mechanics.
English Studies, History, and Law.....	One period a month †.....	Elective Course twice a week.
Modern Languages.....	M. W. F. (3).....	Composition. Spanish.
FIRST CLASS—FOURTH YEAR.		
Steam-Engineering.....	M. W. Th. F. S. (1) W. Th. (2)..... Th. F. (3).....	Marine Engines, Fabrication and Designing of Machinery, and Mechanical Drawing.
Physics and Chemistry.....	T. (1) M. W. (3).....	Physical Measurements.
Mechanics and Applied Mathematics.....	M. (2).....	Strength of Materials.
English Studies, History, and Law.....	T. F. (2).....	Public Law.
Modern Languages.....	T. (3).....	Spanish.

† Theme Periods.—1. Feb. 2 F. (2). { C. M. Seamanship, } 2. Mar. 5 M. (1), Mechanics. 3. Apr. 4 W. (3), Modern Languages. 4. May 7, M. (2), Physics.

EXAMINATION-PAPERS—1875-76.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

MONTHLY EXAMINATION.

DECEMBER 18, 1875.—Time allowed, two and a half hours.

1. What is meant by a root of an equation? What is a quadratic equation? Find the roots of the equation $ax^2 + bx + c = 0$, and find expressions for the sum of the roots, their product, the sum of their squares, and the sum of their cubes. Prove that every equation of the second degree must have two roots and no more. What relation must hold between the coefficients in order that the roots may be *real*? What that they may be *equal*? Form an equation whose roots are the squares of the roots of the equation $ax^2 + bx + c = 0$.

2. Let m denote the mass of the earth and n that of the sun, a the distance between their centres in miles. The attraction of gravitation varies directly as the mass, and inversely as the square of the distance from the centre of attraction. It is required to find the distance from the centre of the earth to the point where the attractions of the earth and sun are equal.

Find also the distance in miles, given $a = 95000000$ miles, and $\frac{n}{m} = 329376$.

3. Reduce $\sqrt{np + 2m^2 - 2m\sqrt{np + m^2}}$ to its simplest form.

Write the square root of each of the following quantities:

$$28 + 10\sqrt{3}, 67 - 16\sqrt{3}, 11 + 6\sqrt{2}, x + y + z + 2\sqrt{xz + yz}, \text{ and } 2a + 2\sqrt{a^2 - b^2}.$$

Solve the following equations (find all the roots):

$$\sqrt{x+5} = \frac{12}{\sqrt{x+12}}, \quad \sqrt{x^2-2}\sqrt{x}=x, \quad \text{and}$$

$$\frac{54-9\sqrt{x}}{x+2\sqrt{x}} = \frac{23x-46\sqrt{x}}{6+\sqrt{x}} + \frac{7x^2-3x+4}{(x+2\sqrt{x})(6+\sqrt{x})}.$$

4. Solve the following equations, finding all the roots in each case:

$$\left. \begin{array}{l} x+y+\sqrt{x+y}=12 \\ x^2+y^2=41 \end{array} \right\}, \quad \left. \begin{array}{l} \sqrt{\frac{3x}{x+y}} + \sqrt{\frac{x+y}{3x}} = 2 \\ xy - (x+y) = 54 \end{array} \right\}, \quad \text{and} \quad \left. \begin{array}{l} y = mx + a \\ \sqrt{x} + \sqrt{y} = \sqrt{a} \end{array} \right\}.$$

5. Given $l = a + (n-1)d$, $s = \frac{n}{2}(a+l)$:

Eliminate n , and find a in terms of d , l , and s ; also eliminate l , and find n in terms of a , d , and s .

Solve the equation $(x-1)^2 + (a-1)^2 = 2(ax+1) + \sqrt{3(x+a)^2 + 4ax}$.

SEMI-ANNUAL EXAMINATION.

JANUARY 23, 1876.—Time allowed, five hours.

1. Simplify the expressions

$$\frac{2x}{3} (x+1) \left\{ x+2 - \frac{1}{2} (2x+1) \right\}, \quad \frac{a(a+b)+b^2}{a} \div \frac{b(a+b)+a^2}{b},$$

and $\frac{x}{6} (x+1) (x+2) + x(x-1) (x-2) + \frac{2x}{3} (x-1) (x+1).$

2. Find the value of

$$\sqrt{\frac{3}{4}-x} + \sqrt{2x} - \frac{3}{2} \sqrt{1-4x} \quad \text{when } x = \frac{1}{12}.$$

Multiply

$$a^{n-1}b - a^{n-2}b^2 + ab^{n-1} \text{ by } ab.$$

Find five terms of the product of

$$\left\{ 1 + \frac{x}{2} + \frac{x^2}{3} + \frac{x^3}{4} + \dots \right\} \text{ by } \left\{ 1 - \frac{x}{3} + \frac{x^2}{5} - \frac{x^3}{7} + \dots \right\}.$$

Write the n^{th} term of each of these series.

3. Multiply

$$a^{\frac{1}{2}} - 2a^{\frac{1}{2}}b^{\frac{1}{2}} + 4a^{\frac{3}{2}}b^{\frac{1}{2}} - 8ab + 16a^{\frac{1}{2}}b^{\frac{3}{2}} - 32b^{\frac{5}{2}} \text{ by } a^{\frac{1}{2}} + 2b^{\frac{1}{2}}.$$

Divide

$$m^2 + 2mp - n^2 - 2nq + p^2 - q^2 \text{ by } m - n + p - q.$$

Divide

$$x^4 + x^4 - x^2 - x^2 \text{ by } x - x^{\frac{1}{2}}.$$

4. Prove that $a^n - b^n$ is divisible by $a - b$. Show that $x^n - 1$ is divisible by $x^r - 1$,

and write the last three terms of the quotient.

5. Separate into factors, $x^2 + 5x + 6$, $x^3 + 4x^2 + 3x$, $ax^2y - axy^2$, $9x^4 - 6x^2y^2 + y^4$, $x^4 + 1$, $a^4 + 64$, and $x^4 + 6x^2 + 121$.

6. Reduce each of the following fractions to its simplest form:

$$\frac{x^2 + (a+c)x + ac}{x^2 + (a+b)x + ab}, \quad \frac{4x^2 - 12ax + 9a^2}{2x^2 - 27a^2}, \quad \text{and} \quad \frac{ax^m - bx^{m+1}}{a^2bx - b^2x^3}.$$

7. Find the greatest common divisor of

$$6a^3 + 19a^2b + 5ab^2 - 5b^3 \text{ and } 15a^4 + 10a^3b + 4a^2b^2 + 6ab^3 - 3b^4.$$

If $x + a$ be the greatest common divisor of $x^2 + px + q$ and $x^2 + rx + s$, what is the value of a in terms of p, q, r , and s ?

8. Simplify the expressions

$$\frac{1}{x-1} - \frac{1}{2(x+1)} - \frac{x+3}{2(x^2+1)} \quad \text{and} \quad \frac{x^{3n}}{x^n-1} - \frac{x^{2n}}{x^n+1} - \frac{1}{x^n-1} + \frac{1}{x^n+1}.$$

9. Solve the equations

$$\frac{1}{4}(x+6) - \frac{1}{12}(16-3x) = \frac{25}{6}, \quad \text{and} \quad \frac{1}{16}(3x+3) + \frac{1}{15}(7x-4) - \frac{1}{20}(7x+1) = 2.$$

10. Solve the equations

$$\frac{x}{a} - 1 - \frac{dx}{c} + 3ab = 0, \quad \text{and} \quad \frac{1}{ab - ax} + \frac{1}{bc - bx} = \frac{1}{ac - ax}.$$

11. Solve the equations

$$\frac{x-y}{x+y} = \frac{1}{5}, \quad \frac{4}{7} \left\{ \frac{2x}{3} - \frac{5y}{12} \right\} - \frac{2}{23} \left\{ \frac{3x}{2} - \frac{y}{3} \right\} = 2,$$

and

$$\frac{x}{a+b} + \frac{y}{a-b} = 2a, \quad \frac{x-y}{4ab} = 1.$$

12. *A* and *B* start together from the same point to walk round a circular course, after half an hour, *A* has walked three complete circuits, and *B* four and a half; assuming that each walks with uniform speed, find when *B* next overtakes *A*.

13. Find the cube root of .00375 to five decimal places.

Find the square root of $a^2 - x^2$ to four terms.

14. Simplify

$$\frac{1 + \sqrt{3}}{2\sqrt{2} - 3\sqrt{3}} \text{ and } \sqrt{18 + 2\sqrt{47}}.$$

Find the value of

$$\frac{\sqrt{a+x} + \sqrt{a-x}}{\sqrt{a+x} - \sqrt{a-x}} \text{ when } x = \frac{2ab}{b^2 + 1}.$$

15. Solve the equations

$$\begin{aligned} \sqrt{4a+x} &= 2\sqrt{b+x} - \sqrt{x}, \\ \sqrt{a+\sqrt{x}} + \sqrt{a-\sqrt{x}} &= b\sqrt{a^2-x}; \end{aligned}$$

16. $x^2 + \sqrt{x^2 - 5} = 11$, and $mqx^2 - mn x + pqx - np = 0$.

17. Develop $\frac{a^2}{(a^3 - x^3)^{\frac{1}{3}}}$ to five terms by the binomial formula.

18. Solve the equations

$$\frac{a - \sqrt{2ax - x^2}}{a + \sqrt{2ax - x^2}} = \frac{x}{a - x};$$

19. $x^3 + 3axy + y^3 = b^3$, $x + y = c$; $(x+1)^5 + (x-1)^5 = 19 \left\{ (x+1)^3 + (x-1)^3 \right\}$.

20. Find all the values of x and y which will satisfy the equations

$$(x^2 + 1)(y^2 + 1) = 10, \text{ and } (x+y)(xy - 1) = 3.$$

ANNUAL EXAMINATION.

JUNE, 1876.—Time allowed, five hours.

1. Find the value of the expression

$$\left\{ \frac{a^2 b^{\frac{1}{2}} + 1}{c^{\frac{1}{2}} d^3 + 5} \right\}^{\frac{1}{11}},$$

given $a = 8.24186$, $b = .00044034$, $c = 561875$, $d = 9.42552$.

2. Find the value of each of the expressions

$$e^{\pi}, \quad \pi^{\frac{1}{e}}, \quad \text{and} \quad \sqrt[10]{\frac{1}{\pi^{1/2} e^{1/3}}}. \quad \left[\pi = 3.1416, e = 2.718 \right]$$

3. Solve the equations—

$$a + x + \sqrt{a^2 + bx + x^2} = b \quad \text{and} \quad \frac{1}{\sqrt{1-x} + 1} + \frac{1}{\sqrt{1+x} - 1} = \frac{1}{x}.$$

4. Find x and y from the equations

$$xy + \frac{x}{y} = \frac{5}{3}, \quad \frac{1}{xy} + \frac{y}{x} = \frac{20}{3}.$$

5. Find x and y from the equations $y = mx + \frac{a}{m}$, $y^2 = 4ax$; and solve the equation $x^3 + 8 = 2x^2 + 11x + 14$.

6. Expand $(a-b)^{-\frac{1}{2}}$ to five terms, and write the first three and last three terms

$$\left\{ \sqrt{x} + \sqrt{y} \right\}^{\frac{1}{10}}.$$

7. The m^{th} term of an arithmetical progression is n , and the n^{th} term is m ; find first term, the common difference, and the sum of $(m+n)$ terms.

Prove that the sum of the cubes of any three even numbers in arithmetical progression is divisible by 24.

8. The equation $x^4 - 4x^3 + 16x - 16 = 0$ has equal roots; find all the roots.

Diminish the roots of the equation $2x^4 - 17x^3 + 53x^2 - 72x + 36 = 0$ by unity, thence solve it.

9. Find all the roots of the equations $x^5 - 14x^4 + 58x^3 - 56x^2 - 59x + 70 = 0$ and $x^4 + 1 = 0$, and find a root of the equation $x^3 + 6ax^2 = 36a^3$.

10. The r^{th} term of $(1-x)^{-\frac{1}{2}}$ is p and the r^{th} term of $(1-x)^{-\frac{3}{2}}$ is q ; find the value of $\frac{q}{p}$ in terms of r . Solve the equation

$$x\sqrt{\frac{x}{y}} + y\sqrt{\frac{y}{x}} = 34, \quad x - y = 12.$$

GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1876.—Time allowed, four hours.

1. Prove that the sum of the angles of any plane triangle is two right angles. Deduce an expression for the sum of all the angles of a polygon of n sides. If the polygon is regular, what is each angle? Prove that in an isosceles triangle the angles opposite the equal sides are equal.

2. Prove that the straight lines which bisect two adjacent supplementary angles are perpendicular to each other. Prove that, if through the middle point of one side of a triangle a straight line be drawn parallel to the base, it will bisect the other side, and the intercepted portion will be equal in length to one-half the base.

3. Prove that, in any triangle, the bisector of an angle, or of its exterior angle, divides the opposite side, internally or externally, into segments which are proportional to the adjacent sides.

4. Prove that the square described on the hypotenuse of a right triangle is equivalent to the sum of the squares described on the other two sides.

5. Prove that a triangular pyramid is one-third of a triangular prism of the same base and altitude, and that the frustum of a triangular pyramid is equivalent to the sum of three pyramids, &c., &c.

6. Define spherical triangle. Explain what is meant by the term *polar triangle*, and state the relation between the parts of a spherical triangle and those of its trihedral angle at the centre of the sphere. Prove that, in two polar triangles, each angle of one is measured by the supplement of the side lying opposite to it in the other.

7. A right triangle ACB , whose sides CA and CB are respectively 12 and 5, is placed with the vertices A and B on two lines OA and OB , which meet at right angles; it is required to find the perpendicular distance of the vertex of the right angle C from each of the lines OA , OB , and the length of the line OC . Given that the angle $OAB = BAC$.

8. A cone is circumscribed about a sphere, and its height is double the diameter of the sphere (radius a). Compare the surfaces and volumes of the cone and sphere.

9. Find the volume of a regular tetrahedron (edge a). A regular hexagon revolves about (1) a line joining two opposite vertices, (2) a line joining the middle points of two opposite sides. Compare the surfaces and volumes of the solids generated.

ALGEBRA.

ELECTIVE COURSE.

Cadet-Midshipmen Abner B. Clements, John Hood, Charles S. Ripley, R. S. Sloan, and F. A. Woodworth.

Cadet-Engineers Richard Gatewood, F. T. Bowles, W. M. McFarland, and M. D. Noell.

JANUARY, 1876.—Time allowed, five hours.

1. Given $\sqrt{x} + \sqrt{y} = \sqrt{a}$, $y = mx + b$. Find values of x and y in terms of a , m , and b , find the relation which must hold between b , a , and m , in order that x and y may each have but one value, and substitute the corresponding value of b , in terms of a and m , in the second of the given equations.

2. Construct the loci of the equations in the preceding question when $a=4$ and $m=2$.

3. Given $y = \frac{x^2 - 2mx + p^2}{x^2 + 2mx + p^2}$, find the limiting values of y . Make a sketch of the locus represented by the above equation.

4. Deduce formulas for the sum of the natural numbers from 1 to n , the sum of their squares, and the sum of their cubes. Prove the latter formula by mathematical induction.

5. If the number of combinations of $2n$ things taken $n+1$ together be to the number of combinations of $2(n-1)$ things taken n together as 132 is to 35, find n . Prove the formulas used.

6. Out of $2n$ men who are to sit at the sides of a long table, p particular men wish to sit on one side and q on the other; find the number of ways in which the company may be arranged.

The p^{th} term of an arithmetical progression is $\frac{1}{q}$ and the q^{th} term is $\frac{1}{p}$; find the sum of pq terms.

7. Find the sum of n terms of the series 5, 55, 555, 5555, &c.

Prove that $2^{\frac{1}{2}} \cdot 4^{\frac{1}{4}} \cdot 8^{\frac{1}{8}} \cdot 16^{\frac{1}{16}} \dots ad\ infinitum$ is equal to 2.

8. On the perpendicular of an equilateral triangle whose side is a , a second equilateral triangle is formed; on the perpendicular of this another, and so on indefinitely. Find the sum of the areas of all these triangles, and the sum of their perpendiculars.

9. Find approximate values of x and y from the equations $y^2 - 2xy + 2x^2 + 4y - 18x + 4 = 0$, and $y^2 + 2xy + x^2 - 24y - 31x + 144 = 0$, by constructing the two loci on the same axes.

10. The series of natural numbers is arranged in groups, thus, 1: 2, 3, 4; 5, 6, 7, 8, 9; and so on. Prove that the sum of the numbers in the n^{th} group is $n^3 + (n-1)^3$.

THEORY OF EQUATIONS.

ELECTIVE COURSE.

Cadet-Engineers Richard Gatewood, Walter M. McFarland, and F. T. Bowles.

Cadet-Midshipmen Abner B. Clements and Charles S. Ripley.

JUNE, 1876.—Time allowed, five hours.

1. Let $f(x)$ denote any rational integral function of x . Substitute $x+y$ for x ; write $f(x+y)$ arranged according to the ascending powers of y , and show how the coefficients of the expansion are formed.

Prove that $\frac{xf'(x)}{f(x)} = n + \frac{S_1}{x} + \frac{S_2}{x^2} + \dots + \frac{S_m}{x^m}$, where S_m denotes the sum of the m^{th} powers of the roots.

2. Prove that if the equation $x^3 - px^2 + qx - r = 0$ have two equal roots, the third root must satisfy either of the equations $x(x-p)^2 = 4r$, and $(x-p)(3x+p) + 4q = 0$.

3. Determine the relation between q and r necessary in order that the equation $x^3 + qx + r = 0$ may be put into the form $x^4 = (x^2 + ax + b)^2$, and thence solve the equation $3x^3 - 36x + 27 = 0$.

4. Give an explanation of Horner's method of approximation, and find a root of the equation $x^4 - 12x + 7 = 0$ to five decimal places by this method.

5. Express a root of the equation $x^3 + x^2 + x - 7 = 0$ as a continued fraction, and give five convergents.

6. Find by Sturm's theorem the number and position of the real roots of the equation $x^4 - 4x^3 - 3x + 23 = 0$.

7. Transform the equation $34x^5 + 80x^4 + 80x^3 + 40x^2 + 10x + 1 = 0$ to another in which the fourth term is wanting; thence solve the equation.

8. Trace the curve $x^3 - x^2y - ax^2 + 4a^2y = 0$; find the maximum and minimum ordinates, and the point of inflexion.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND
LAW.

HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1876.—*Time allowed, five hours.*

[Starred questions are alternatives.]

1. To what group and family of nations do the Russians belong? the Wallachians? the Turks? the English? the Bretons? the Arabs? the Swedes? the Finns? the Portuguese? (Take five.)

2. Give the dates of any five of the following: 1. Danish occupation of England (beginning and end). 2. Magna Charta. 3. Hegira. 4. First Punic war (two dates). 5. Alexander's expedition. 6. Battle of Marathon. 7. Great Interregnum (two dates). 8. First Crusade.

3. Explain the names (or expressions):—1. Constantinople. 2. Caliph. 3. Languedoc. 4. Patriarch. 5. Austria. 6. Marquess. 7. Regular clergy. 8. Crossing the Rubicon. (Take four.)

4. Tell something about any three of the following:—1. Aetius. 2. Charles Martel. 3. Alfred. 4. Frederick Barbarossa. 5. Charles the Bold. 6. Edward the Black Prince.

5. Name the four families that reigned successively as Roman emperors between 800 and 1250 A. D., and give the names of the rulers of any one of these families in the order of their reigns.

6. (a) "The history of the East does not give the same political teaching as that of the West." How so?

(b) What was the Aryan dispersion?

6*. Compare the geographical character of Greece and Italy, and show how each influenced the character of the people.

What races and principles were represented by Athens and Sparta respectively in the Peloponnesian war?

7. "The old Roman constitution was really democratic, but it had a tendency to become practically aristocratic." Explain these terms, and show how the change came about.

7*. "Before the time of Diocletian, the empire had become a military monarchy." Explain.

8. How did Switzerland come to be an independent state?

8*. Explain feudal tenure, showing how it originated, and what were its effects.

9. What were some of the effects of the crusades?

9*. Show how Mahometanism, in the fifteenth century, both gained and lost ground in Europe? (Give dates.)

10. Draw a map of Western Europe, in the time of Otto the Great, putting down the boundaries of the Roman Empire, Kingdom of Burgundy, Duchy of Burgundy, Kingdom of France (Francia), Duchy of Normandy. Note also the position of Laon, Paris, Toulouse, Arles, Mainz, Trier, Constanx, Ravenna, Milan, Florence, Rouen, Dijon, Tours, and the following rivers: Rhone, Rhine, Elbe, Weser, Po, Loire, Elbe, Seine, Garonne.

HISTORY OF THE UNITED STATES.

ANNUAL EXAMINATION.

JUNE 15, 1876.—*Time allowed, five hours.*

[Starred questions (*) are alternatives.]

1. Name the colonies in 1638, and give the form of government in each at that time.
- 1*. Four colonial wars: dates; causes; corresponding wars in Europe; treaties. State the territorial changes accomplished by the last three.
2. Give some account of (1) Sir E. Andros, (2) Lord Cornbury, (3) Burr, (4) Truxton, (5) Garrison, (6) Barron. (Take three.)
3. Give a brief account of the operations of the Navy during the war with Mexico.
- 3*. Show the connection between the legislation under which Missouri was admitted as a State and that under which Kansas was organized as a Territory.
4. Explain the terms (1) patroon, (2) proprietary government, (3) writs of assistance, (4) articles of confederation, (5) quartering acts, (6) tariff, (7) excise. (Take four.)
5. Explain the Monroe doctrine, and give an account of its application in 1866-67.
- 5*. State the measures included in the compromise of 1850, and give an account of the contest which ended in their adoption.
6. Give an account of the movements which led to the constitutional convention.
- 6*. Describe the proceedings in the Continental Congress which led to the adoption of the Declaration of Independence.
7. Name in order the six ministries in England between 1762 and 1775, and refer to each the acts which were initiated by it relating to the colonies.
- 7*. Explain the difference between the taxes of which the colonies complained and those to which they made no objection.
8. Administrations, 1789-1869: dates; President and Vice-President. Refer the following to the administrations in which they belong: 1. Jay's treaty; 2. Embargo; 3. Florida purchase; 4. Webster-Ashburton treaty; 5. Secession ordinance in South Carolina; 6. Ostend manifesto.
9. Give some account of the following: 1. Jones's cruise in the *Ranger*; 2. Mission of Genet; 3. Southampton massacre; 4. Dred Scott case; 5. Crittenden compromise; 6. Geneva arbitration. (Take three.)
10. Draw a map showing the boundaries of the Louisiana cession of 1803 and of the territory from which slavery was excluded by the Missouri compromise.

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY 24, 1876.—*Time allowed, five hours.*

[Starred questions (*) are alternatives.]

PUNCTUATION.

1. Give the rules for the use of points in connection with marks of parenthesis in the following cases:
 - (1) When, in the absence of a parenthesis, no point would be needed;
 - (2) When, in the absence of a parenthesis, a comma would be needed;
 - (3) When the parenthesis needs a point of its own.

ENGLISH.

2. Show that English is a Teutonic rather than a Romance language.
3. What is meant by the terms "classical Latin" and "revival of letters"? In what four ways did Latin influence English?
- 3*. "The Northmen, who had become Frenchmen in France, became Englishmen in England." Explain.

4. Explain the formation of *ripen* ; *children* ; *alms* : *third* from *three* ; *one* in the sense of *they* ; *ought*.

5. Explain the terms *aorist tense*, *finite verb*, *analytic stage* in a language, *co-ordinative conjunction*.

6. Explain the three classes of subordinate clauses.

6*. Explain the case of the end or object.

7. "O kind hosts and dear,	(1)
Hearken a little unto such a tale	(2)
As folk with us will tell in every vale	(3)
About the yule-tide fire, when the snow	(4)
Deep in the passes, letteth men to go	(5)
From place to place : now there few great folk be,	(6)
Although we upland men have memory	(7)
Of ills kings did us ; yet as now indeed,	(8)
Few have much wealth, few are in utter need."	(9)

Turn the poetry into prose of the present day. Explain the construction of *dear* (1), *hearken* (2), *little* (2), *deep*, (5), *there* (6), *be* (6), *us* (8).

8. What can you say about the number of *folk* (6)? the form of *letteth* (5)? the difference between *few* (6) and *few* (9)? the direct object of *did* (8)?

9. Explain the principal parts of *tell* (3), *letteth* (5), *did* (8). Explain the formation of *yule-tide* (4), *upland* (7), *indeed* (8).

10. "Once in an ancient city, whose name I no longer remember,
Raised aloft on a column, a brazen statue of Justice
Stood in a public square, upholding the scales in its left hand,
And in its right a sword, as an emblem that justice presided
Over the laws of the land, and the hearts and homes of the people."

Analyze.

ENGLISH LESSONS.

ANNUAL EXAMINATION.

JUNE 13, 1876.—Time allowed, five hours.

[Starred (*) questions are alternatives.]

1. Name the six laws of linguistic change, and give an illustration of each, showing from the etymology of the word how the law applies.

1*. Distinguish by the method of elimination between the words *wisdom* and *ingenuity*, between *monarch* and *autocrat*. (Take either pair of words, but not both.)

2. What is *fine writing*, and how is it to be avoided? When are poetic quotations and periphrases admissible?

3. What is the best broad rule for writing English prose? To what qualifications is this rule subject?

4. Explain personification, expressed metaphor, psychological phenomena, ballad, romance, plot, epic poem.

4*. What is the aim of scientific composition? How does it differ in this respect from non-scientific composition?

What rules govern the arrangement of argument in oratory?

5. Explain briefly the difference between induction and deduction. Explain the *argument from analogy*.

6. Explain the difference between definition and description, and between essentials and accidents, giving examples.

Explain *syllogism*, *variable middle*, *begging the question*.

7. The common proverb "Fortune favors fools" is found in various forms in all the languages of Europe. To what sources of error is it due that such a proposition obtains popular credence?

8. Ill-doers are ill-dreaders. This man dreads evil, and is, therefore, a scoundrel. Explain the error, and draw a diagram.

8*. No branch of science can be made absolutely perfect, yet all branches of science are worthy of diligent culture.

State the inference, draw diagram, and explain.

[In answering 8 (or 8*), designate the middle term, minor term, major premise.]

9. Unpleasant things are not always injurious; afflictions are often salutary.

Supply the missing premise.

9*. All cold is expelled by heat: this person's disorder is a cold; and must, therefore, be expelled by heat.

Explain and point out the error.

10. Prose version:

"Thus sang the uncouth swain to the oaks and rills,
While the still morn went out with sandals gray;
He touched the tender stops of various quills,
With eager thought warbling his Doric lay:
And now the sun had stretched out all the hills,
And now was dropped into the western bay;
At last he rose and twined his mantle blue;
To-morrow to fresh woods, and pastures new."

Explain the figures.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE 10, 1876.—*Time allowed, four hours.*

Translate into French the following sentences:

1. Where were you going when I met you this morning?
2. I was going to market with my friend; then we went to Mr. B.'s store to purchase some things that we needed.
3. Can you tell me if you bought anything in market or at the store you visited?
4. Yes; we found some large strawberries and other nice things to eat; but, spending all our money, we were unable to purchase anything at Mr. B.'s store.
5. Tell me the names of some other things which you found for sale at the market; for I am a stranger here, and know very little of what they have to sell.
6. Well, there were poultry, fish, beef, lamb, pork, potatoes, corn, fresh eggs, and all other things generally sold in market.
7. How long is it since you came to the Naval Academy?
8. I have been here these two years, and I must say that I am much pleased with the Academy. It is very agreeable; but we have to study a good deal: our lessons are long, and, besides, we have to drill every day.
9. When the weather is bad, what do you have to do?
10. Sometimes we remain at home, but generally our instructors find something for us to do. On Mondays we drill as infantry; on Tuesdays as artillery. On Wednesdays we have nothing to do—have study-hours. On Thursdays we go to the ships, and on Fridays we do everything.
11. Are you permitted to have any leave of absence during your stay at the Naval Academy?
12. That depends upon circumstances: if we study our lessons, and behave well during the time we are here, we are permitted to visit our families once in four years. If any one at home should be ill, or should die, then we are permitted to go home, if it is not too far.

13. In what State do you live when you are at your home ?
14. I live in the State of New Jersey, near the sea-coast ; but we have a railroad and steamboats on the river where the city in which I live is situated.
15. When you go into the country, do you ever go hunting or fishing ?
16. Not often : there is no game in the country where I live ; but there is a good deal of fishing, though one must be careful not to remain out after the sun sets.
17. Will you please tell me how often each day you receive your letters by the post ?
18. The first year that I came here we used to get our mail but once a day ; now we receive our letters twice a day, and they talk of having three mails a day.
19. Is your uncle to come back soon from his long voyage ?
20. We do not know when he intends to return. His last letter was written in the month of January. He says he is not far from the desert of S.
21. When do you intend going to France for your son, who is there at school ?
22. Not yet ; I am only going to see him. He has been long enough in France to be able to speak French fluently. I suppose he will be anxious to return with me.
23. Somebody told me yesterday that Miss M. was going to marry neighbor H.'s son. Is it true ?
24. Really, I cannot say ; but he is certainly very attentive to the young lady. She is very pretty, well educated, and rich.
25. What have you been doing to-day ?
26. I walked the whole morning, breakfasted at twelve, and went out in the afternoon to call on an old friend, who lives in William street, near the corner.
- Give the primitive tenses and the conjugation in all simple tenses, and the first person of all compound tenses of the following verbs ;
Être, manger, aller, recevoir, venir, and prendre.

THIRD CLASS.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

MONTHLY EXAMINATION.

NOVEMBER 22, 1875.—*Time allowed, two and a half hours.*

All formulas used to be deduced by Napier's rules, and the work to be checked. Write the formulas in order, and number them, draw a diagram for each case, and work to the nearest second.

1. In a right triangle, given $a, 33^{\circ} 30' 45''$; $B, 129^{\circ} 30' 45''$. Solve the triangle.
2. Given $A, 100^{\circ} 30' 30''$; $b, 10^{\circ} 30' 30''$; $c, 79^{\circ} 29' 30''$. Find B and a .
3. Given $A, 100^{\circ} 30' 30''$; $C, 79^{\circ} 29'$; $b, 10^{\circ} 30' 30''$. Find B and a .
4. Given $A, 110^{\circ} 30'$; $B, 60^{\circ} 30'$; $b, 50^{\circ} 30'$. Find a and c .
5. Given $b, 69^{\circ} 34' 30''$; $c, 120^{\circ} 30'$; $B, 50^{\circ} 10'$. Solve the triangle.

MONTHLY EXAMINATION.

DECEMBER 6, 1875.—*Time allowed, two and a half hours.*

[Solutions of five questions required.]

1. Define the terms *horizon, prime-vertical, meridian, altitude, declination*. What points are the poles of the meridian ? of the prime-vertical ? Explain what is meant by the *astronomical triangle*, and name its parts. In the stereographic projection of the sphere where is the point of sight, and on what plane is the projection made ? What two important advantages has this method of projection ? Show that $D = r \tan \frac{1}{2} \phi$, where D

denotes the distance of the projection of a point from the centre of the primitive circle, r the radius of the sphere, and θ the polar distance. Assuming that the subcontrary section of an oblique cone with a circular base is a circle, show that the stereographic projection of any circle of the sphere is a circle, and find expressions for the distances of the extremities of one of its diameters from the centre of the primitive circle.

2. Prove that the angle between any two tangents to circles of the sphere is equal to the angle of their projections. Show how to find the line which contains the centres of the projections of all great circles passing through a given point, and give a proof of the construction. Prove, that the *line of centres* coincides with the projection of a circle whose polar distance is equal to the supplement of the inclination of the pole.

3. Given $L, 44^\circ 50' N.$; $t, 60^\circ 10' W.$; $d, 59^\circ 45' N.$; find h and Z . (Deduce formulas by Napier's rules in terms of the given parts.)

4. Given $t, 22^\circ 30'$; $d, 29^\circ 55' 30'' N.$; $h, 59^\circ 51' 30''$. Find L .

5. Make a stereographic projection of the triangle in (3) on the plane of the prime-vertical and on the plane of the meridian, and project the triangle in (4) on the plane of the equator. In these projections only the *given* parts are to be used, taking them to the nearest degree.

6. At a place in north latitude, when the sun's declination was $22^\circ 30' N.$, the altitude of the sun was 45° , and 3 hours later the altitude was 60° . Find the latitude by making a stereographic projection on the plane of the equator. The result must be stated in degrees and minutes. Determine also from the projection the times of observation.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876—Time allowed, five hours.

[Solutions of 18 questions required.—Without tables.]

1. Define the trigonometric ratios. Deduce formulas showing the relation between the sine and cosine, the relation between the tangent and secant, and the relation between the chord and sine. Deduce the trigonometric ratios of 30° and 45° .

2. Write the formulas for the sine and cosine of $(x \pm y)$, and thence deduce formulas for the sine, cosine, and tangent of $2x$ and $\frac{1}{2}x$, and for $\tan(x \pm y)$ and $\tan(y \pm 45^\circ)$.

3. Find the sine, cosine, and tangent of each of the angles 15° , $22^\circ 30'$, and 18° .

4. Given $y = \sec^{-1} \frac{x}{a}$; find the sine, cosine, and tangent of y .

Find x from the equation $\cos^{-1} x + \cos^{-1} (1-x) = \cos^{-1} (-x)$,

and z from the equation $\tan^{-1} \frac{1}{z-1} - \tan^{-1} \frac{1}{z+1} = \frac{\pi}{12}$.

5. In a right triangle, given an angle A and its opposite side a , find expressions for the radii of the circumscribed and inscribed circles.

Solve the equation $\sec \theta = 2 \tan \theta$.

6. In a plane oblique triangle, given A , B , and c , find the remaining parts.

7. In a plane oblique triangle, given a , b , and C , find the remaining parts.

8. State and prove the theorem which shows the relation between the three sides and one angle of a triangle.

Given the three sides 3, 5, and 7, find the greatest angle.

9. Deduce formulas for the solution of the *three-point problem* (the diagram must be drawn and explained).

10. Deduce formulas for the logarithmic solution of the equations

$$\tan(a+z) = m \tan z, \text{ and } m \cos z + n \sin z = q.$$

11. State and prove De Moivre's theorem.

Write the sine, cosine, and tangent of $4x$ in terms of the functions of x .

12. Assuming the formula $\cos a = \cos b \cos c + \sin b \sin c \cos A$, deduce the formula $\sin A \sin b = \sin B \sin a$.

13. Deduce the formulas used in the solution of spherical right triangles.

14. Deduce the formula $\sin^2 \frac{1}{2} A = \frac{\sin(s-b) \sin(s-c)}{\sin b \sin c}$, and apply it to the astronomical triangle to find t . Arrange the work for computation.

15. Given the declination of the sun and the latitude of the place, show how to find the time of sunset. Given the latitudes L_1 and L_2 and the longitudes λ_1 and λ_2 of two places on the earth, show how to find the distance between them.

16. The sides of a plane triangle are $2\sqrt{6}$, and $3 - \sqrt{3}$; find the angles.

17. Given $a \cos \phi + b \cos \theta = c$, $a \sin \phi - b \sin \theta = d$, and $2 \sin \left(\frac{\theta + \phi}{2} \right) = \cos \frac{\pi}{3}$, find the relation between a , b , c , and d .

18. A vessel sailing NNE. sees two light-houses in line, bearing ESE.; 2 hours afterwards the light-houses bore SSE. and S., the distance between them being 6 miles; find the rate of the ship.

19. Solve the equations

$$\begin{aligned} \sin x + \sin y &= \cos x + \cos y = \frac{1}{2} \sqrt{6}, \\ \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right) + \tan^{-1} \left(\frac{2x}{1-x^2} \right) &= \frac{4}{3} \pi. \end{aligned}$$

20. What is the distance of the sea horizon from an observer whose eye is 18 feet above the level of the sea? Answer required in yards and miles. (Radius 4000 miles.)

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—Time allowed, five hours.

Solutions of nine questions required.

1. Find the log tangent of $317^\circ 30' 30''$, log cosine of $-111^\circ 30' 30''$, and log secant of $269^\circ 30' 30''$.

Find an angle between 2π and 4π whose sine is negative, and whose cotangent is 0.275.

Given $u = \theta (\tan \theta) \tan \theta$, find u when $\theta = 15^\circ$.

The hypotenuse of a right triangle is 7040003 and one side is 7040000; find the included angle.

2. Given two sides of a plane triangle 2920.9 and 1430.3, and the included angle $107^\circ 27' 40''$, solve the triangle, and find the perpendicular from the vertex of the least angle upon the opposite side.

3. In a quadrilateral $ABCD$, given AD , 2345; CA , 42° 17'; CAB , 37° 53'; CDB , 46° 32'; and BDA , 38° 51'; find BC .

4. Solve the equations $k \cos(\alpha + z) = m$, and $k \cos(\beta + z) = n$; given α , $100^\circ 18'$; β , $35^\circ 10'$; m , -0.5734; and n , 0.4527 (k positive).

Solve the equation $ax^2 + bx + c = 0$, given a , 2.527; b , 3.452; c , -2.432.

5. Given the three sides of a plane triangle, a , 32.235; b , 51.125; c , 40.156; find A from the formula $a^2 = b^2 + c^2 - 2bc \cos A$; B from $\sin^2 \frac{1}{2} B = \frac{(s-a)(s-c)}{ac}$; and C from $d = \frac{(b+c)(b-c)}{a}$, $\cos C = \frac{a+d}{2b}$.

6. In a spherical triangle, given A , $110^\circ 27'$; B , $70^\circ 25'$; c , $64^\circ 20'$; find C and a (Napier's rules).

7. Given a , $65^\circ 34'$; b , $53^\circ 24'$; C , $80^\circ 20'$; solve the triangle by Napier's analogies and the fundamental formula.

8. Given t , $70^\circ 20'$; d , $23^\circ 28' N$.; h , $25^\circ 22'$; find L and Z .

9. A vessel sails from a place in latitude $30^\circ 30' N$., longitude $75^\circ W$., and follows the arc of a great circle, her course at starting being NE. $\frac{1}{2} E$. What latitude and longitude will she be in after sailing 3500 nautical miles.

10. Given $x = \cot L \sin \theta$, $y = L + \cot L - \cot L \cos \theta$, $\theta = \pi \sin L$; find values of x and y corresponding to values of L at intervals of 15° from 90° to 0° , and trace the curve.

ANALYTICAL GEOMETRY.

SEMI-MONTHLY EXAMINATION.

FEBRUARY 18, 1876.—*Time allowed, two and a half hours.**Solutions of five questions required.*

1. Deduce the following equations to the straight line: (a) In terms of m and c ; (b) in terms of the intercepts; (c) in terms of a and p .

Deduce the equation to a straight line which passes through (x_1, y_1) with the direction ratio m , and the equation to a line passing through (x_1, y_1) and (x_2, y_2) .

2. Find the equations to straight lines passing through (h, k) and making an angle β with $y = mx + c$. What forms do these equations take when $\beta = \frac{\pi}{2}$? Find the length of the perpendicular from (h, k) upon $y = mx + c$.

3. Deduce formulas by which the axes may be turned through any angle, the origin remaining fixed; when both systems are oblique, and when both systems are rectangular.

4. Find the equations to the following lines: (a) Joining $(-3, 4)$ and $(5, 2)$; (b) perpendicular to (a) at its middle point; (c) passing through $(4, -5)$ parallel to $5y + 3x - 7 = 0$; (d) passing through $(2, 4)$ and making an angle of 45° with $3y - 4x - 9 = 0$.

Find the angle between the lines $5y + 4x - 7 = 0$ and $2y - x + 8 = 0$, and the length of the perpendicular from $(3, 2)$ upon $12y - 5x - 30 = 0$.

5. Construct the locus of the equation $x^2 + y^2 + xy + 13(x + y) + 96 = 0$.

Find what this equation becomes when the origin is taken at the centre of the curve, and what the resulting equation becomes when the axes are turned through an angle of 45° .

6. A right angle moves so that its vertex is constantly on the axis of Y, while one of its sides passes through a point on the axis of X at a distance a to the right of the origin; from the point $(-a, 0)$ a perpendicular is let fall upon the other side. It is required to find the equation to the locus of the foot of this perpendicular, and to trace the curve from its equation.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Find the angle between the lines $7x + y = 64$ and $4y + 3x = 56$. Find the area of the triangle formed by these lines and the axis of Y. Find the equation to a perpendicular let fall upon the second of the given lines from the point where the first crosses the axis of Y; find also the length of this perpendicular.

2. A right triangle ACB is placed with the vertex A on the axis OY, and the right angle C on the axis OX, the vertex B being in the first angle. Find the co-ordinates of B and the equation to the sides of the triangle, given $AC = 4$, $BC = 3$, and the angle $OCA = 60^\circ$.

3. Find the equation to the tangent to $x^2 + y^2 = a^2$ in terms of its direction ratio m .

Find the equation to a circle passing through the origin and the points $(7, 1)$, $(-1, 7)$.

Find the general equation to the circle in oblique co-ordinates.

4. Find an expression for the perpendicular from the focus of the parabola $y^2 = 4ax$ upon the tangent. (In terms of m).

Find the polar equation to the parabola, pole at focus, and an expression for the length of a focal chord.

Find the equations to all the normals to $y^2 = 4ax$ which pass through $(9a, -6a)$.

5. Deduce the equation to the ellipse referred to conjugate diameters.

Prove that the area of the parallelogram which touches the ellipse at the extremities of conjugate diameters is constant.

Express the equations to the tangent and normal to the ellipse in terms of the eccentric angle.

6. Deduce the equation to the hyperbola referred to its asymptotes as axes, and the equation to the tangent in terms of its direction ratio referred to the same axes.

Find the polar equation to the locus of the foot of the perpendicular let fall from the centre of an equilateral hyperbola upon the tangent.

7. Find the co-ordinates of the centre and the eccentricity of the conic

$$34x^2 - 32xy + 34y^2 - 4x - 104y - 344 = 0.$$

Find the equation to the axis of the parabola

$$(y - x)^2 = a(x + y).$$

8. Suppose the triangle given in example (2) to move so that the vertices A and C remain constantly on the axes. Find the equation to the locus of B , and also the locus of the middle point of AB .

9. Find the equations to those tangents to the ellipse $a^2 y^2 + b^2 x^2 = a^2 b^2$ which pass through $\left(\frac{a}{e}, \frac{b^2}{ae}\right)$. Find the equation to the locus of the middle points of focal chords of the ellipse.

10. Parabolas are drawn passing through the origin and intercepting a distance a on each axis. Find the locus of the intersection of the tangent at the origin and the tangent at the point $(0, a)$.

DIFFERENTIAL CALCULUS.

ELECTIVE COURSE.

Cadet-Midshipmen J. H. Fillmore, J. H. Glennon, J. G. Quinby, T. S. Rodgers, H. S. Knapp, and F. L. Young.

Cadet-Engineers I. N. Hollis, E. J. Schell, H. W. Spangler, G. H. Bull, and G. W. McElroy

JANUARY, 1876.—Time allowed, five hours.

1. Deduce formulas for the differentiation of x^2 , $\sqrt{x}$, xy , $\frac{1}{x}$, and $\frac{x}{y}$.

2. Deduce the differentials of $\log x$ and a^x , and, by means of the formula for $d(\log x)$, deduce the differential of x^a .

3. Write the differentials of $\sin x$, $\cos x$, $\tan x$, $\sin^{-1} x$, and $\tan^{-1} x$, and deduce those of $\operatorname{versin}^{-1} x$, $\log \sin x$, $\log \tan x$, $\sin \log x$, and x .

4. Differentiate the expressions $\frac{x}{x^2 - 1}$

$$\log \left\{ \sqrt{1+x^2} + \sqrt{1-x^2} \right\}, \text{ and } x + \log \cos \left\{ \frac{\pi}{4} - x \right\}.$$

5. Differentiate $\tan^{-1} x$, $\frac{x\sqrt{a^2-x^2}}{2} + \frac{1}{2} \sin^{-1} \frac{x}{a}$,

and

$$\frac{1}{2} \cdot \log \left\{ \frac{(x-1)(x+1)}{x^2+x+1} \right\} - \frac{1}{\sqrt{3}} \tan^{-1} \frac{2x+1}{\sqrt{3}}.$$

6. Given $u = x^5 - 5x^4 + 5x^3 - 1$, find the values of x for which u is a maximum or minimum.

What sector must be cut from a given circle (radius a), in order that the remainder may form the curved surface of a cone of maximum volume?

7. Given $x^4 - 2ay^3 - 3a^2y^2 - 2a^3x^2 + a^4 = 0$, find the value of $\frac{dy}{dx}$ at all the points where the curve crosses the axes.

8. Find the value of $\frac{1-x+\log x}{1-\sqrt{2x-x^2}}$ when $x=1$; of $x \tan x - \frac{\pi}{2} \sec x$, when $x = \frac{\pi}{2}$, and of $\frac{\sin(a+\beta) \sin(a+x) - \sin \beta \sin x}{\sin(a+\beta+x)}$, when $x = \pi - (a+\beta)$.

9. The equations to a meridian in the polyconic projection are

$$x = \cot L \sin \theta, y = L + \cot L - \cot L \sin \theta.$$

Find the value of x and y for $L = 0$ and $\frac{dy}{dx}$ for $L = 30^\circ, p = \pi$. ($\theta = p \sin L$.)

10. The equation to a curve being $(x+3)y^2 = (y+4)x^2$, find the equations to the asymptotes and construct them; find the maximum and minimum ordinates and abscissas; find the equations to the tangents at the origin, and trace the curve.

DIFFERENTIAL AND INTEGRAL CALCULUS.

ELECTIVE COURSE.

Cadet-Engineers H. W. Spangler, F. J. Schell, I. N. Hollis, and G. H. Bull.

Cadet-Midshipmen J. H. Fillmore, J. G. Quinby, J. H. Glennon, and T. S. Rodgers.

JUNE, 1876.—Time allowed, five hours.

1. Demonstrate Taylor's theorem and deduce La Grange's form of the remainder.

2. Expand $e^{x \sin x}$ to five terms in powers of x .

3. Prove that if $u = \frac{F(x)}{f(x)}$ and $F(x)$ and $f(x)$ both vanish when $x = a$, then the value of u when $x = a$, is $\frac{F'(a)}{f'(a)}$.

Find the value of $\frac{\theta^2}{1 - \cos m\theta}$ when $\theta = 0$, of $x^{\frac{1}{1-x}}$ when $x = 1$, and of $x^{\frac{a}{\log \sin x}}$ when $x = 0$.

4. Trace the curve $\frac{y}{a} = \sqrt{\frac{x}{2a-x}}$ and find the points of inflexion.

5. Find the equation to the evolute to the equilateral hyperbola.

6. A straight line cuts, from the co-ordinate axes, intercepts a and b , such that $na + b = c$. Find the equation to the envelope of these lines.

7. Trace the curve $y^4 + ax^2(2y-x) = 0$, and find the area of the loop.

8. Integrate the expressions $\frac{x dx}{(a^4 - x^4)^{1/2}}$, $\frac{dx}{\sin^2 x \cos^2 x}$, $\frac{\sin^{-1} x dx}{(1-x^2)^{1/2}}$, and $\frac{x e^x dx}{(1+x)^2}$.

9. Integrate $\frac{x^2 dx}{x^4 + x^2 - 2}$, $\frac{dx}{(1+x^2)(1-x^2)^{1/2}}$, and $\int_0^{\pi/2} \cos^8 x dx$.

10. A circular segment whose arc is 90° revolves about its chord; find the volume generated.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELEMENTARY PHYSICS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—Time allowed, five hours.

1. When are different bodies equal in mass?

2. State the laws of gravitation.

3. With what velocity must a body be projected downwards in order to strike the earth with a velocity of 200 feet per second after moving 5 seconds?

4. A vessel contains water to the depth of 1 decimetre. One side of this vessel is a rectangular surface, the bottom of which is 1 decimetre, while the side slopes at an angle of 45° . What is the total pressure on this side?

5. A piece of gun-metal weighs 1.5 kilogrammes in the air and 1.33 kilogrammes

- ster; the metal is an alloy of tin (specific gravity, 7.3) and copper (specific gravity, 9). What proportions do these metals enter into the composition?
6. State, and illustrate by an example, the doctrine of the conservation of energy.
7. How is sound transmitted?
8. Upon what does the velocity of sound depend?
9. Upon what does the intensity of sound depend?
10. If the velocity of sound in one gas be known, how may its velocity in other gases be found?
11. What are the two fixed points used in graduating a thermometer? and how is the one marking the higher temperature determined?
12. What are the readings of -10° C. and 400° C. on the Fahrenheit scale? what on absolute scale?
13. What must be the diameter of a cast-iron shot at 15° C. to be fired red-hot (900° C.) from a IX-inch gun, allowing $\frac{1}{16}$ inch windage? Coefficient of expansion (linear) of iron .000011.
14. A quantity of gas measures 1 litre at 10° C. and 770 millimetres pressure. What will be its volume at 30° C. and 760 millimetres?
15. One kilogramme of ice at 0° is placed in 5 kilogrammes of water at 60° C., and the temperature is reduced to 44° C. What is the latent heat of liquefaction by this experiment?
16. Define specific heat. How does the specific heat of a substance vary with change of state?

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, four hours.*

1. State the laws of the reflexion of light, and apply them to determining the focus of a concave spherical reflector.
2. An object 10 centimetres high is placed successively at distances of 1 metre, 40 centimetres, 20 centimetres, 15 centimetres, and 5 centimetres, from a concave mirror of 20 centimetres radius. Find the position and magnitude of the image for each position of the object.
3. Explain the phenomena of reflection and single refraction by the undulatory theory.
4. An object 10 centimetres high is placed successively at distances of 5 metres, 1 metre, and 10 centimetres, from a double convex lens of 30 centimetres focal length. Find the position and magnitude of the image for each position of the object.
5. Compare the radiation from polished platinum, green glass, and black porcelain, when viewed in a white-hot chamber; explain why they appear differently when viewed at this same temperature outside the chamber.
6. Describe electro-static induction, and explain by it the action of the plate electrical machine.
7. Describe fully the construction and action of an electrical condenser. How may it be discharged?
8. State Ampère's theory of magnetism, and explain by it the directive action of currents upon magnets.
9. Explain the construction of an astatic system. How is it applied in the galvanometer to determine the direction and measure the strength of a current?
10. Describe the induction of currents of electricity by other currents.

CHEMISTRY.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Nitric acid of sp. gr. 1.5 contains 92.98 per cent. of HNO_3 . What volume of this acid will be required to convert 500 grammes of glycerine into tri-nitro-glycerine? What weight of tri-nitro-glycerine will be obtained?

2. Describe tri-nitro-glycerine and the method by which it is manufactured. Show by graphic formulas the structure of the glycerine and tri-nitro-glycerine molecule. What is a nitro-substitution product?

3. In the following reaction find the numerical coefficients: $a \text{ Hg C}_2 \text{ N}_2 \text{ O}_2 + b \text{ K Cl} + c \text{ H}_2 \text{ O} = w \text{ K Cl} + x \text{ Hg Cl}_2 + y \text{ Hg O} + z \text{ H K}_3 \text{ C}_3 \text{ N}_3 \text{ O}_3$.

4. We have a hydrocarbon which we find by analysis belongs to the series $\text{C}_n \text{ H}_{2n}$. 3.1360 grammes of the substance yields 1196 cm^3 of gas at 45°C . and 74 cm. of pressure. What is its formula? Explain your work.

5. From 5 cm^3 of P (sp. gr. 1.8), what volume of gaseous hydrogen phosphide will be obtained at 15°C . and 74 cm. of pressure? Illustrate the volume composition of gaseous hydrogen phosphide, and show what would be its condensation ratio if obtained by the direct union of H and P.

6. Prove that the sp. gr. (referred to H) of a substance in the state of a gas gives us one-half its molecular weight.

7. Describe sulphur.

8. Give the empirical formulas, chemical names, and molecular weights of the following substances: India saltpetre, oil of vitriol, sal ammoniac, muriatic acid, chloride of lime, charcoal, common salt, gypsum.

9. Define valency; atomicity. How can we show that if the valency of an element is ever odd it is always odd? Point out the valency of each element in the following compounds: H I , C H_4 , $\text{H}_2 \text{ O}_2$, S O_2 , C O_2 , $\text{H}_4 \text{ N O H}$, N I_3 , K C N .

10. What is gunpowder? To what does it owe its energy? What is the philosophy of its composition? What advantages does sodium nitrate possess over potassium nitrate? Which is used in regulation powder? Why?

Substitute for question (7.)—Describe fully, with reactions, the preparation of O in the laboratory.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

HISTORY AND RHETORIC.

SEMI-ANNUAL EXAMINATION.

JANUARY 25, 1876.—*Time allowed, five hours.*

RHETORIC.

[Starred (*) questions are alternatives.]

1. Distinguish between:—1. Loose sentence and period; 2. Clearness and simplicity; 3. Genus and species; 4. Concrete and abstract; 5. Subject world and object world; 6. Example and illustration. *Take three.*

2. Explain:—1. Mixed metaphor; 2. Fable; 3. Synecdoche; 4. Illative conjunction; 5. Unity; 6. Description; 7. Narrative; 8. Exposition; 9. Induction; 10. Deduction. (Take five.)

3. Explain what is meant by plurality of knowledge, and show what connection it has with antithesis.

3*. When is the use of hyperbole justifiable, and what are the limitations upon its use?

4. "The more general a notion is, the more difficult it is to conceive." Explain.

4*. Discuss Herbert Spencer's principle that qualifying words should precede the objects which they qualify.

5. Show that originality is a condition of strength; and explain why compositions sometimes have the power to please after frequent repetition.

5*. Give the main rules for the structure of the paragraph.

6. Explain the importance of chronology and geography in historical narrative.

6*. (a) What is meant by saying that some nations have a geography, but not a history?

(b) "The framing of summaries is conducted in a variety of ways." Name some of them.

7. What rules govern the choice of examples used to illustrate a scientific exposition?

7*. "The proof of a principle indirectly contributes to its exposition." Show this.

8. How may "obverse iteration" be used to aid exposition?

8*. Explain definition by analysis.

9. Make up sentences which shall contain the words given below, used as examples of the figures named:

- | | |
|---------------------|------------------|
| 1. Simile. | Dream, river. |
| 2. Metaphor. | Fountain, heart. |
| 3. Personification. | Savage, humor. |
| 4. Paradox. | Skull, roar. |
| 5. Antithesis. | Weary, stain. |
| 6. Hyperbole. | Frenzy, whisper. |
| 7. Climax. | Storm, folly. |

10. Write a simple, clear, condensed narrative of an event or incident, real or fictitious, witnessed or supposed to have been witnessed by you, which shall, as far as possible, follow the principles given in the text-book. The narrative shall be at least one page in length, and shall contain at least two paragraphs.

HISTORY AND RHETORIC.

ANNUAL EXAMINATION.

JUNE 14, 1876.—Time allowed, five hours.

[Starred (*) questions are alternatives.]

RHETORIC.

1. Name and explain the four methods of inductive proof. Show what other forms of persuasion may take beside that of argument.

2. Characterize the following argument, and point out fully its defects: "As there could be in natural bodies no motion of anything, unless there were some that moveth all things, and continueth immovable; even so in political societies there must be some unpunishable, or else no man shall suffer punishment."

CONSTITUTION OF THE UNITED STATES.

3. Define or explain direct tax, common law, charter government, bill of attainder, grand jury, *ad valorem* duties.

4. Explain the operation of the writ of *habeas corpus*, and show when and by whose authority it may be suspended.

4*. What things are necessary to a legal contract? What may a State do, and what is it forbidden to do, in regard to contracts?

5. What was the purpose of the electoral college? How does the system work in practice?

5*. State and give the reason for the constitutional prohibitions on members in regard to holding office.

6. State the qualifications for Representatives; for electors of Representatives; for Senators; for President; for Vice-President.

6*. What is the prohibition on the houses of Congress in regard to adjournment? On what does the duration of the sessions of Congress depend? Explain the "call for the yeas and nays"; the method, the real or ostensible object, and the process.

7. With whom rests the power to prescribe regulations for holding elections of Representatives? to try impeachments? to fill senatorial vacancies during the recess of

the State legislature? to permit officers to receive foreign decorations? to appoint consuls? to appoint militia officers? to declare war? to make treaties? to admit new States?

8. Explain equity jurisprudence, concurrent and exclusive jurisdiction, original and appellate jurisdiction. In what cases does the Supreme Court exercise appellate jurisdiction?

OFFICIAL REPORT.

9. Write an official report of the practice-cruise of 1875, addressed to the Commandant of Cadets, in the form prescribed.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

SPECIMEN-QUESTIONS.

JUNE, 1876.—*Extempore translation from French into English.*

Quelques jours après, la gazette annonça que l'empereur était à Paris, et qu'on allait couronner le roi de Rome et l'impératrice Marie-Louise. M. le maire, M. l'adjoint et les conseillers municipaux ne parlaient plus que des droits du trône, et même on fit un discours exprès dans la salle de la mairie. C'est M. le professeur Burguet l'aîné qui fit ce discours, et M. le baron Parmentier qui le lut. Mais les gens n'étaient pas attendris parce que chacun avait peur d'être enlevé par la conscription, on pensait bien qu'il allait falloir beaucoup de soldats; voilà ce qui troublait le monde et pour ma part j'en maigrissais à vue d'œil. M. Goulden avait beau me dire: "Ne crains rien, Joseph, tu ne peux pas marcher. Considère mon enfant qu'un être aussi boiteux que toi resterait en route à la première étape."

Tout cela ne m'empêchait pas d'être rempli d'inquiétude.

On ne pensait déjà plus à ceux de la Russie, excepté leurs familles. M. Goulden quand nous étions seuls à travailler, me disait quelquefois.

Si ceux qui sont nos maîtres, et qui disent que Dieu les a mis sur la terre pour faire notre bonheur peuvent se figurer, au commencement d'une campagne, les pauvres vieillards les malheureuses mères auxquels ils vont en quelque sorte arracher le cœur et les entrailles pour satisfaire leur orgueil; s'ils pouvaient voir leurs larmes et entendre leurs gémissements au moment où l'on viendra leur dire: "Votre enfant est mort. Vous ne le verrez plus jamais! il a péri sous les pieds des chevaux, ou bien écrasé par un boulet, ou bien dans un hôpital, au loin—après avoir été découpé—dans la fièvre, sans consolation, en vous appelant comme lorsqu'il était petit," &c., &c.

1. Explain the rules of contraction and elision.
2. How are adjectives usually placed in French?
3. Explain places of the pronouns and how many kinds there are.
4. Explain the uses of the imperfect and past definite tenses.
5. How distinguish the conjugations in French?
6. Explain idioms with *faire*.
7. What verbs are used to express approximate future and a past just elapsed?

CONVERSATION IN FRENCH.

WRITTEN EXAMINATION.

Time allowed, two hours.

[Translate into French.]

(1) If you wish to be wise, and esteemed by mankind, be exact in the fulfilment of all your duties, assiduous in your business, and polite to everybody.

(2) Sir Isaac Newton, who lived eighty years, wore during winter his summer clothes

in order to accustom himself to all changes of the atmosphere and to all degrees of temperature without being inconvenienced by them.

(3) History, it is said, is philosophy teaching by example; but it is also the picture of times and men, and is consequently the image of inconstancy, caprice, and endless variations.

(4) The distinguishing characteristic of a Roman was love for liberty and his country. One of these things made him love the other; since because he loved his liberty he also loved his country, as a mother who brought him up in sentiments equally generous and free.

(5) One is astonished at beholding so much magnificence in the sepulchres of the Egyptians, but we must remember that, besides that they were erected as sacred monuments to carry to future ages the memory of great princes, they were also considered as eternal dwelling-places.

(6) What is religion? A sublime philosophy which demonstrates the order, the unity of nature, and explains the enigma of the human heart, the most powerful motive to urge man on to well-doing, since faith places him continually under the eye of God, and acts upon the will with as much power as upon thought; it enjoins, strengthens, and brings to perfection all virtues.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SHIP-BUILDING.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—*Time allowed, four hours.*

WOODEN-SHIP-BUILDING.

1. Describe the keel, explaining fully the manner of uniting the different lengths, and how the keel is connected with the stem and stern-post.

What is the length of the keel-scarph?

Where do the ribs of the scarph come? Why?

Where do the butts of the keelson come?

Elevation and plan-sketches of keel.

When ready to receive the frames, what marks should be on the keel?

2. Describe a square frame; long and short arm floors, stating the names of the different timbers composing it, and the manner of uniting them.

How does the framing differ when first futtocks are used? What are cant frames? Why are they necessary?

Describe raising and regulating the $\oplus$ frame, and how frames are made to retain their proper form while being raised and regulated.

What are ribbons and harpins, where placed, how secured? What are filling-timbers, chocks, and hawse-pieces?

3. Name the different parts of the deck-frame. Describe the manner of ascertaining the lengths of deck-beams and manner of securing a deck-beam in place.

What portion of the deck-frame is worked next after the beams? Why?

4. How are mast-partners worked? Describe the framing of a hatch. What are water-ways, where placed, how secured? How are the deck-planks placed and secured?

5. Make a sketch of sectional view of a ship, showing outside and inside planking, sheer-plank, and hammock-nettings, and describe the same fully.

6. What is the object of diagonal bracing? Describe the different methods of diagonally bracing modern ships, stating which method is most often adopted, and why. Describe the different kinds of rudders. How is an equipoise rudder connected to a ship?

7. Describe the different kinds of docks used.

Describe the manner of docking a vessel in a dry-dock, also in a sectional dock.

8. Describe the fittings and preparations necessary to get a ship ready for launching. How is a ship launched? How prevent hogging in a long ship when launching?

IRON SHIP-BUILDING.

Time allowed, four hours.

1. Illustrate and describe the different forms of keels used in the *transverse* system of framing. Illustrate and describe the entire keel-arrangement of an *iron-clad ship* built on the *bracket-plate* system. Give *sectional, plan, and elevation sketches*. Why are *internal vertical keels* necessary? Describe the different forms in use.

2. Make an *outline sketch* of the stem of an *iron-clad ram*. Show, by *sectional sketches* how it is connected with the keel and outside plating; and show how the *body and rudder-posts* are connected with the keel.

3. Describe the different kinds of framing, and how the frames are bent. Describe the *bracket-plate* system of framing, explaining fully the manner of dividing the double bottom into water-tight compartments. Illustrate the method of forming the *armor-shelf*.

4. Illustrate and describe briefly the different systems of plating (*sectional sketches*). State the advantages or disadvantages of each system.

Define *liners*, state their use, and show how they are made in connection with the *water-tight* compartments.

5. In the system of plating now in general use, describe fully the manner of fitting *plates*, (giving size of rivets, and taking account of *rivet-holes*, using templates.) What is meant by *sheathed and composite ships*? State, in general terms, the reasons given for building such vessels. Make a *sketch* of one system of sheathing vessels.

6. Describe *armor, backing, plating, and framing behind armor*. How is *armor secured*? Describe the *fastenings* and the general size of *bolts*.

7. Make *sectional drawings* of the different forms of beams; name and describe them briefly.

How are the beams *spaced* in a man-of-war? What is the rule for *size of beams* of a vessel?

Describe *deck-stringers* and their use.

Illustrate and describe the different methods of forming the *beam-arms*.

8. Describe the manner of forming a *transverse water-tight bulkhead*; illustrate the manner of connecting it with the *ship's side*. Show how *longitudinal bulkheads* are made water-tight in connection with deck and *T* beams.

NAVAL TACTICS.

ANNUAL EXAMINATION.

JUNE, 1876.—Time allowed, four hours.

1. What is a general signal? how made?

How may a division, squadron, or vessel be exempted from obedience to a general signal?

What is a special signal? how made?

When is a manœuvre commenced?

What is the speed-signal (day and night)? how made?

2. The fleet being in column of vessels, in natural order, heading north, form it into double columns of vessels, abreast by divisions, heading NE. $\frac{1}{2}$ N., in natural order. State fully how the courses are signaled.

3. The fleet being in double columns of vessels, abreast by divisions, in natural order, heading NE. $\frac{1}{2}$ N., form it into column of vessels, on the centre division, in natural order, and preserving the original direction.

4. The fleet being in columns of vessels, abreast by divisions, in natural order, heading N., form it into column of vessels, on the right division, with the van leading, course SW. $\frac{1}{2}$ S.

5. The fleet being in column of vessels, in close order, form it into open order, on any vessel which may be designated.

The fleet being in double columns, in open order, form it in close order on any vessel which may be designated. State the distances between the vessels in each case.

6. The fleet being in double column on the centre, heading north, form it into line to the right or left, at right angles to the original direction (three methods).

7. The fleet being in line, heading north, form it into echelon of vessels from the right, preserving the original direction.

The fleet being in echelon of vessels, heading north, form it into double echelon from the left-centre vessel, preserving the original direction.

8. The fleet being in columns of vessels abreast by divisions, by the wind, and *headed off*, restore its order on the same tack. The wind *veers* aft; restore its order on the same tack.

SEAMANSHIP.

ORAL EXAMINATION—SPECIMEN QUESTIONS.

JUNE, 1876.

I.

1. Reeve, cut, and fit main topgallant braces.
2. How do you furl a square sail?
3. Get sheet-anchors ready for use, bend their chains, &c.
4. Cut, fit, and set up main-stays; wire rope.
5. Set a topmast studding sail.
6. Wind on the quarter, studding sails set; bring by the wind on the same tack.

II.

1. Reeve, cut, and fit main-topsail halliards.
2. Describe a main-sail; state how it is fitted.
3. Get ready for and hoist in a launch on port side.
4. Cut, fit, and set up main topgallant stay; wire rope.
5. Take in a topmast studding sail.
6. Wind on the quarter, studding sails set; *man overboard*; what is to be done?

III.

1. Reeve, cut, and fit mizzen topgallant halliards.
2. Make up fore topmast staysail for bending; bend it.
3. Fore-mast in, rake sheers, and take in bowsprit.
4. Cut, fit, and set up main royal stay; wire rope.
5. Set a topgallant studding sail.
6. By the wind, under all plain sail; *man overboard*; what is to be done?

IV.

1. Reeve, cut, and fit fore topsail halliards.
2. Make up main-sail for bending.

3. Rig the lower mast-head, and set up rigging.
4. Cut, fit, and set up jib-guys; wire rope.
5. Take in a topgallant studding sail.
6. How do you wear ship short around?

V.

1. Reeve, cut, and fit fore royal braces.
2. Describe a royal; state how it is fitted.
3. Get up purchases, secure yard, and get in heavy gun over all.
4. Cut, fit, and set up bobstays; wire rope.
5. Set all the starboard studding sails.
6. How do you box-haul a ship?

VI.

1. Reeve, cut, and fit mizzen topsail halliards.
2. Bend and furl topgallant sails and royals.
3. Fit main stays of wire; set them up.
4. Cut, fit, and set up fore topgallant stay; wire rope.
5. Take in all starboard studding sails.
6. Tack ship, under all plain sail, fine breeze.

VII.

1. Reeve, cut, and fit main royal braces.
2. Describe a jib; state how it is fitted.
3. How is a fish-davit rigged and worked?
4. Fit odd shroud of mizzen rigging; wire rope.
5. Ship close-hauled, take one reef in the topsails.
6. How do you club-haul a ship?

VIII.

1. Reeve, cut, and fit lower studding-sail halliards.
2. Describe a spanker; state how it is fitted.
3. Fit topmast rigging of wire; place rigging on foretopmast head.
4. State in general terms how wire rope is made.
5. Set the topsails, giving all the orders, and stating what is done at each.
6. In tacking, your ship is not inclined to go around; what would you do?

IX.

1. Reeve, cut, and fit fore topmast-studding-sail halliards.
2. Bend a topmast studding sail.
3. How do you send up, place, and secure half-tops?
4. Fit odd shroud of fore or main rigging; wire rope.
5. Take in a main-sail, fresh breeze, by the wind.
6. Wind on the quarter, light breeze, bring by the wind on the same tack.

X.

1. Reeve, cut, and fit spanker brails.
2. Topmasts housed; get ready for and fid them.
3. Make preparations for and hoist out launch.
4. Cut and fit lower mast-head pendants; wire rope.
5. Take one reef in the topsails, ship before the wind.
6. Light weather, ship close-hauled; keep away ten points, and trim and sail.

DEPARTMENT OF ORDNANCE AND GUNNERY.

INFANTRY TACTICS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—*Time allowed, four hours.*

1. Give the kinds of commands; reasons for and advantages of "position of soldier," in detail.
2. Give cadence and length of *all* steps; principles of, and how instruct recruits in the direct step; and how instruct recruits to align themselves.
3. Describe rest on arms from carry; fire kneeling; right shoulder, from support. What parts of manual do guides, color-guard, and file-closers execute?
4. Form a company; form column of fours to the right; form line on the right in single rank.
5. Column of platoons at a halt, form company; advance by right of platoons.
6. Company on the march, deploy skirmishers forward; open fire advancing; rally by company.
7. Post a battalion of seven companies (by seniority); open ranks.
8. Column of fours, right in front, form close column of divisions on the right, and deploy it on the third division.
9. Change front obliquely to rear to protect right flank of battalion; open fire by file.
10. Battalion in column of fours, deploy forward as skirmishers; reinforce the skirmish-line; assemble the battalion.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ASTRONOMY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—*Time allowed, four hours.*

1. Define right ascension, declination, hour-angle, azimuth, amplitude, celestial latitude, celestial longitude, stating how each is measured. Define vertical circles, celestial horizon, upper branch of meridian, and line of nodes of a planet's orbit.
2. Explain the pendulum experiment which proves the rotation of the earth on its polar axis. How do trade-winds prove the same?
3. Show by a figure the equation of time. Define it in terms of the sun's right ascension and longitude, as well as in terms of hour-angle. Of what two parts is it composed, and what occasions each of the parts?
4. How mount a transit-instrument approximately in the meridian (reducing deviations to small quantities)?
5. Deduce Bessel's formula for the reduction to the meridian, showing parts by a figure.
6. How find the latitude by Talcott's method? Name instrument used and the method of taking the observation.
7. Define common and corrected establishment of a port. How find time of high water at a given place? What occasions the inequality of lunital intervals during the lunar month?
8. Project on the plane of the meridian the following astronomical triangle: $L = 30^{\circ} \text{ N.}$; $t = 30^{\circ} \text{ W.}$; $d = 45^{\circ} \text{ N.}$; and the equator.
9. State the cause of the inequality of the solar days. What gives rise to the inequality between the solar and the sidereal day? Which is the longer? Define the tropical and the sidereal year. Which is used in our calendar, and why?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Two electrified spheres, A and B, are connected by a very fine wire. What will be the distribution of electricity? How will this distribution be affected, (1) if the potential of either sphere be changed? (2) if the size of either be changed?

2. What will be the effect upon a current flowing in a helix if the current be allowed to force out a magnet previously placed within the helix? what, if the magnet be forced back into the helix? Give reason for your answer in each case.

3. How is the horizontal component of the earth's magnetic intensity measured?

4. Describe the tangent-galvanometer, and the method of using it. Derive the expression for the current measured by it.

5. What weight of silver will be deposited per hour by a dynamo-electrical machine which develops an E. M. F. of 60 volts, when the resistance of the machine is 5 ohms and that of the electrolyte 9.5 ohms, the electro-chemical equivalent of silver being 0.00552 grammes?

6. The resistance of 1 metre of copper wire 1 millimetre in diameter is 0.02057 ohms. What length of copper wire 0.75 millimetres in diameter will be required for a shunt which will diminish 100-fold the sensibility of a galvanometer of 500 ohms resistance?

7. Show how to measure an unknown resistance, using Wheatstone's bridge. Prove the theory of the bridge.

8. The current necessary to fire a torpedo-fuse is 0.6 weber. The resistance of the fuse being 0.4 ohm and that of the leading wires 1.75 ohms, what will be the smallest number of cells, of E. M. F. 1.4 volts per cell and R. 2.5 ohms per cell, required to fire a torpedo, and how must they be arranged?

9. Draw diagrams and explain the construction of Farmer's dynamo-electric machine and torpedo firing key.

10. What are the requisites of a good marine compass? How are these requisites secured? Give the methods by which the magnetic moment of a compass-card may be determined.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

SEMI-ANNUAL EXAMINATION.

CALCULUS.

JANUARY 24, 1876.—*Time allowed, five hours.**Ten solutions required.*

1. A hatchway, whose diagonal is 8.64 feet, is enclosed between the spar-deck and the hold; required the length of the longest spar that can be passed below, providing the hold be 5 feet in depth.

2. Determine the angle which a rudder makes with the keel of a ship when its turning effect is the greatest possible.

Find the value of $\left(2 - \frac{x}{a}\right)^{\tan \frac{\pi x}{2a}}$ when $x = a$.

3. Oil flows at a uniform rate into a conical oil-tank 3 feet in height, which stands on its base, filling the tank in 27 minutes; determine the rate at which the surface is rising at the end of 19 minutes; also when the surface reaches the top.

4. A vessel sailing due south, at the uniform rate of 8 knots per hour, is 20 miles north

of a vessel sailing due east, at the rate of 10 knots per hour; at what rate are they separating at the end of 1½ hours?

Show that the derivative of $\log(x + \sqrt{x^2 - a^2}) + \sec^{-1} \frac{x}{a}$ is $\frac{1}{x\sqrt{x^2 - a^2}}$.

5. If a point move along the axis of x , so that

$$t = \sqrt{\frac{a}{2u}} \left\{ \sqrt{ax - x^2} - \frac{a}{2} \operatorname{vers}^{-1} \frac{2x}{a} \right\},$$

find the velocity at any point, and show that the acceleration is equal to $-\frac{\mu}{x^2}$.

6. Find the parallel on the earth's surface at which the difference between the geocentric and the geographical latitude is the greatest.

7. Deduce the requisite series, and compute $\log_e 163$.

8. Deduce Simpson's "three-eighths" rule for computing areas and volumes.

Find the value of $\frac{\tan x}{\log(x - \frac{\pi}{2})}$ when $x = \frac{\pi}{2}$.

9. Deduce the equation to the loxodromic curve, and show that the entire length of its projection on the plane of the equator is $R \sec C$, where C is the course and R the radius of the earth.

10. A ship is constructed on the wave-line plan, the midship section being a semi-ellipse and the stem and stern-post vertical; deduce the formula for determining the displacement of the after-body, also that of the fore-body.

11. In example 10, find the distance of the centre of gravity of the fore-body from the midship section.

Trace the curve $r = 1 + \cos 3\phi$, and find the area of one of its loops.

12. A scuttle-butt has for its base an ellipse whose principal diameters are 52 inches and 28 inches, and for its top an ellipse whose principal diameters are 40 inches and 22 inches, and its height is 24 inches; required the number of wine-gallons of 231 cubic inches it will contain.

MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1876.—Time allowed, five hours.

Eight solutions required.

1. A torpedo-spar 30 feet long and weighing 300 pounds is shackled to the ship's side directly under the fore-yard; the torpedo attached to the end of the spar is 4 feet in length and weighs 250 pounds; the topping-lift which supports the spar is made fast at a point 5 feet from the outer end of the spar, to which it is perpendicular: find the tension on the lift, the horizontal thrust, and vertical pressure on the shackle, the angle which the spar makes with the horizon being 30° .

Find the relation between the power and the weight in the differential axle.

2. A chain hangs over two pulleys placed at unequal heights above the ground; deduce the equation to the curve formed by the portion between the pulleys, and prove that the extremities are in the same horizontal plane.

3. Find the relation between the tensions at the two ends of a cord wrapped around a rough cylinder.

A weight of five tons is to be raised from the hold of a steamer by means of a single whip, the fall being taken to the drum of a steam-windlass; the diameter of the drum is 14 inches, that of the rope 2 inches, and the length of the crank 16 inches: find the force which a man must exert at the end of the fall when he has $3\frac{1}{2}$ turns round the drum, the coefficient of friction being 0.234; find also the power which must be applied at the end of the crank to hold it in equilibrium.

4. A wooden quadrangular pyramid weighing 50 pounds per cubic foot, whose base is 10 feet square and whose height is 12 feet, rests on one of its triangular faces: find the work required to turn it over on its base.

5. Find the time of vibration of a simple pendulum (three terms required).

6. A right cone, whose altitude is equal to twice the radius of its base, is suspended by its vertex and by a diameter of its base: determine the ratio of the times of vibration.

7. A smooth elastic ball is projected horizontally from the top of a tower 100 feet in height, with a velocity of 100 feet per second, and after one rebound describes a horizontal range of 40 feet: determine the coefficient of elasticity.

Determine the angle of elevation necessary that a shot may pass through a point given by its coordinates.

8. Prove that the depth of penetration of a spherical projectile is determined by the formula

$$S = \frac{w}{2\mu c^2 g} \log_{10} (1 + \frac{\mu}{\lambda} V^2),$$

in which w denotes the weight in pounds, and c the calibre in inches.

Find the depth of penetration in oak of a ten-inch projectile, having a velocity of 1468 feet per second. $\lambda = 2329.4$, $\mu = 0.004328$.

9. A sluice-gate in the form of a semicircle of 4 feet radius turns on a horizontal axis. At what distance below the centre must this axis be placed, that the gate may open when the water rises to the height of 5 feet above the top of the gate?

10. Find the quantity of water that will flow per second through a circular 12-inch aperture in the side of a ship, tangent to the water-line.

11. A hemispherical diving-bell is sunk in water until the surface of the water in the bell bisects the vertical radius; find the distance between the surfaces of the water within and without the bell.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

Oral examination.

JANUARY, 1876.—*Translation from French into English extempore.*

Le 15 janvier 1814, deux mois et demi après la bataille de Hanaü, je m'éveillai dans un bon lit, au fond d'une petite chambre bien chaude; et, regardant les poutres du plafond au-dessus de moi, puis les petites fenêtres, où le givre étendait ses gerbes blanches, je me dis: "C'est l'hiver!" En même temps, j'entendais comme un bruit de canon qui tonne, et le pétilllement du feu sur un âtre. Au bout de quelques instants m'étant retourné, je vis une jeune femme pâle assise près de l'âtre, les mains croisées sur les genoux, et je reconnus Catherine. Je reconnus aussi la chambre où je venais passer de si beaux dimanches, avant de partir pour la guerre. Le bruit du canon qui revenait de minute en minute, me faisait peur de rêver encore.

Et longtemps je regardai Catherine, qui me paraissait bien belle; je pensais: "Où donc est la tante Grédel? Comment suis-je revenu au pays? Est-ce que Catherine et moi nous sommes mariés? Mon Dieu! pourvu que ceci ne soit pas un rêve!"

À la fin, prenant courage, j'appelai tout doucement: "Catherine!" Alors, elle, tenant la tête, s'écria:

"Joseph tu me reconnais?" "Oui," lui dis-je, en étendant la main.

Elle s'approcha toute tremblante, et je l'embrassai longtemps. Nous sanglotions et sembla.

Et comme le canon se remettait à gronder, tout à coup cela me serra le cœur.

"Qu'est-ce que j'entends, Catherine?"

"C'est le canon de Phalsbourg," fit-elle en m'embrassant plus fort.

"Le canon?"

"Oni, la ville est assiégée."

"Phalsbourg! Les ennemis en France! . . ."

Je ne pus dire un mot de plus.

Translation from English into French.

Henry the Eighth, king of England, having quarrelled with Francis the First, king of France, resolved to send him an ambassador bearing to that prince haughty and threatening words. He chose for that purpose an English bishop in whom he had great confidence and whom he thought fitted for carrying out his design. The prelate having learned the occasion of his embassy, and fearing for his life if he should treat Francis the First with the haughtiness which his master required, represented to him the danger to which he exposed him, and earnestly entreated him not to give him that commission. "Fear nothing," said Henry the Eighth; "if the king of France should put you to death, I would cut off the heads of all the Frenchmen in my kingdom." "I believe you, sire," replied the bishop; "but permit me to tell you that of all the heads you would cut off not one would fit my body so well as my own."

Conversation in French.

Oral examination.

1. Explain the rules of contraction in French.
2. Explain the rules of elision.
3. What is the place of adjectives in French?
4. Give some adjectives which do not follow the general rule of position.
5. Tell all about demonstrative pronouns and their variations.
6. Give the idioms formed with the verbs *avoir, être, aller, and faire*.
7. Explain the agreement of past participles.
- Explain the subjunctive mood.
8. What verb is used in speaking of age.
9. Explain the formation of tenses.

10. Conjugate all moods and tenses of the verbs *aller, faire, bouillir, conclure, and coudre*.

Nautical phrases.—Translate into English.

1. Tont le monde en haut pour diminuer de voiles.
2. Sur la perpendiculaire de notre route.
3. Laissez tomber le point de la grand'voile sous le vent.
4. Rangez du monde sur l'amure de grand'voile.
5. Passez du monde sur le bord.
6. Embarquez le grand bras.
7. La batterie aux sabords.
8. Gréez les bonnettes de perroquet.
9. Veillez aux drisses des huniers.
10. Dressez le canot.

Translate into French.

1. Shorten in the lee main tack.
2. That ship is hull down.
3. All hands about ship.
4. All hands loose sails.
5. All hands reef topsails.
6. In topgallant-sails.
7. Prepare for action.
8. Clear the ship for action.
9. On which side shall we board that vessel?
10. Heave to and I will send a boat on board.

DEPARTMENT OF MODERN LANGUAGES.

SPANISH.

ANNUAL EXAMINATION, JUNE, 1876.

Translate into Spanish the following French dialogue between a Spaniard and an American:

Spaniard. Comptez-vous aller voir l'exposition de Philadelphie ?

American. Certainement, la fête séculaire de notre république, embellie des triomphes de l'agriculture, de l'industrie, et des arts du monde entier, est un événement d'un double intérêt pour nous.

S. Cela est vrai, monsieur, et ce double intérêt sera partagé par bien des étrangers. L'exposition américaine, outre les produits de l'intelligence, et du travail présentés dans les expositions de Londres, de Paris et de Vienne, offre à la vue des penseurs le spectacle d'une nation riche, heureuse, entièrement développée dans sa jeunesse; et ils s'en demanderont la raison. Vos institutions politiques sont exposées à Philadelphie aussi bien que le sont les triomphes de votre industrie, et de votre travail; et n'en doutez pas, ce produit de l'intelligence d'un grand peuple fera réfléchir bien des hommes, et, peut-être, bien des nations.

A. Ce compliment est très-flatteur, et je vous en sais bon gré. Vous pensez, donc, que c'est un succès ?

S. Oui, monsieur, les choses nécessaires, utiles et agréables ont atteint ici un très-haut degré de perfection. Dans cet hémisphère vous pouvez soutenir la concurrence européenne. Quant aux beaux arts, et aux choses purement de goût, le triomphe est, peut-être réservé à d'autres nations, l'américain le reconnaîtra volontiers. Votre supériorité industrielle, l'abondance du pays, vos excellentes écoles publiques, vos institutions libérales, fixeront ici la demeure de plusieurs artistes et mécaniciens célèbres, attirés par votre exposition, et vous profiterez de leurs talents.

A. Nous nous reverrons à Philadelphie ?

S. Cela va sans dire . . . si Dieu le veut.

A. Vous avez raison; les accidents des chemins de fer et des bateaux à vapeur sont assez fréquents; il faut, donc, dire, "au revoir, si Dieu le veut!"

Conjugate in all their tenses and moods the irregular verbs: *Ser, aspir, caber, conocer, and acertar, &c., &c.*

ORAL QUESTIONS.

1. What is the position of the pronouns "It" and to "It"?
2. How when the verb is in the infinitive ?
3. When both pronouns have to be made use of, which one comes first ?
4. Explain when "*to be*" is to be translated by "*ser*" and when by "*estar*".
5. Translate "*this*" and "*that*", and give the meaning of the three ways by which both can be rendered in Spanish.
6. Give the months of the year in Spanish, &c., &c., &c.

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, JUNE, 1876.

I.

1. Describe the watch, quarter, and station bills of a frigate; state in general terms the information given by them, naming the different station bills.

2. How are the collars of lower and topmast stays formed ? (Wire rope.)

3. State the numerals and symbols used in recording the force of wind, state of the weather, and form of clouds, in the journal or log.

4. Heave-to and discharge pilot, good working breeze.

5. Under all drawing sail, wind on starboard quarter, round-to on the port tack under single-reefed topsails.

6. Send down lower yards.

7. Sailing-vessels meeting, wind NE., one heading NW., the other ESE., which has the right of way ?

II.

1. What are the duties of the officer of the gun-deck ?

2. Describe the manner of measuring for rigging with a fore and aft draft and beam scale.

3. Make preparations for a hurricane (at sea).

4. Set all the starboard studding sails.

5. Close-hauled, starboard tack, moderate weather, change course four points to port, trim and make sail.

6. Send up and cross topsail yards.

7. Being officer of the deck of a steamer at night, you sight a red light four points on the starboard bow. What is the rule of the road governing both vessels ?

III.

1. When and how is the log hove ? who heaves it ? and how is it noted ?

2. State in what order the rigging goes over the foremast head.

3. You are in a cyclone in the North Atlantic, ship hove-to, wind east, blowing stronger, without changing its direction, what should you do ?

4. Ship close-hauled, take one reef in the topsails.

5. Make preparations for sea, call all hands up anchor, and see officers and men at their stations.

6. How do you furl sails ? (loosed to a bowline).

7. Steamers meeting, one steering SW., the other W. by N., which has the right of way ?

IV.

1. State in general terms the outline of a fire-bill and what is done on the alarm or fire.

2. State the difference, if any, between the rigging of the fore, main, and mizzen-mast heads.

3. Believing your ship to be in a cyclone in the South Atlantic, ship hove-to; you have the wind SE., then S., how would you proceed ?

4. Wear ship, moderate breeze.

5. Close-hauled on starboard tack, you observe a squall on starboard bow, how will you proceed ?

6. Shift main topsail.

7. Sailing-vessels meeting, wind S. by W., one steering N. by E., the other NNE., which has the right of way ?

V.

1. What are clothes-lists, when and how are they made out, and who keeps them ?

2. State in what order the rigging goes over the fore topmast head.

3. Believing your ship to be in a cyclone in the North Atlantic, ship hove-to, you have the wind SE., then S., how would you proceed ?

4. Tack ship, good working breeze.

5. By the wind on the starboard tack, the wind comes out on the lee bow, what will you do ?

6. Make preparations for and bend sails.

7. Steamers meeting, one heading north, the other east, which has the right of way ?

VI.

1. What is a berthing bill, how is it made out, and how are the men distributed?
2. Why does the mizzen mast have one lower and one topmast stay?
3. What are the indications of a cyclone? How does the wind revolve in the northern and how in the southern hemisphere?
4. Turn out the reefs in the topsails.
5. Before the wind, studding sails both sides, change course eight points to starboard.
6. Make preparations for loosing sails to a bowline, and loose them.
7. Sailing-vessels meeting, wind north, one steering SE., the other SW., which has the right of way?

VII.

1. How is a ship's company messed? How many men are usually placed in a mess and how are cooks to messes appointed?
2. In measuring for standing rigging, how are the distances for eye-seizings and so for dead-eyes ascertained?
3. Under sail close-hauled, how would you get a cast of the lead in about twenty fathoms of water?
4. Take in all starboard studding sails, breeze freshening.
5. How do you wear ship, blowing fresh, heavy sea?
6. By the wind, weather main-brace parts, how proceed?
7. Sailing-vessels meeting, wind N. by E., one steering S., the other S. by E., which has the right of way?

VIII.

1. Name the different day and the different night lookouts. What men are stationed to take these several lookouts?
2. Describe dead-eyes for setting up wire rigging.
3. As officer of the deck of a steamer, how would you get a cast of the lead in about thirty fathoms of water?
4. How do you close-reef the topsails?
5. Stand in, on a wind, under all plain sail, and anchor.
6. Cross topgallant and royal yards and bend the gear.
7. Being officer of the deck of a steamer at night, you sight a vessel showing mast head and side-lights right ahead, what is the rule of the road to avoid collision?

IX.

1. Into how many watches are the men divided? Name them. What is the necessity for dog-watches? Who musters the watch, and how and when is it done?
2. Describe in general terms the method of cutting and fitting wire rope.
3. How would you inspect a life-boat at sun-down and report her ready for service?
4. Set studding sails both sides.
5. How do you box-haul? When is it resorted to?
6. A steamer meeting a sailing-vessel, wind N., steamer steering NE., sailing-vessel SW., how should both vessels be handled to avoid collision?

X.

1. What are the duties of the officer of the fore-castle?
2. State in general terms how wire rope is made.
3. In reference to other ships, shoals, or any danger, how should a ship's head be cast in getting under way? why?
4. Fresh breeze, plain sail to royals, before the wind, bring by the wind on the starboard tack.
5. Riding head to wind and tide, get underway, cast to port, and stand out on a starboard tack.
6. Send down topgallant and royal yards.
7. What is done by vessels at anchor in a fog? Where do vessels usually anchor in a harbor to avoid collision?

NAVAL ARCHITECTURE.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. What is buoyancy, and on what principle does it depend? Define stability, and show on what it depends. What is the *metacentre*? What is a fair *metacentre* height for an ordinary ship? How is easy rolling insured, and how is the principle applied to modern-built vessels?

2. Give the three rules for working out areas of plane figures. How are volumes of solids measured? Deduce formula for Simpson's second rule.

3. Name and describe the plans commonly used in designing vessels. How is the displacement of a ship computed? How is the centre of buoyancy determined? State how the new centre of buoyancy is found after the ship is heeled, and deduce the formula for finding the metacentre. Define the coefficient of fineness.

4. How is the centre of buoyancy of a model found? Deduce formula for determining the centre of gravity of a vessel equipped for sea, and explain a practical method of making the calculations.

5. Give the rules for computing the registered tonnage of United States vessels, and describe the manner in which the measurements are taken. Show how the centre of effort of a ship's sails is found.

6. Deduce equations for statical and dynamical stability, and show on what the maximum angle at which a ship can safely heel depends.

7. State what is meant by design, and describe the principal lines used in designing a ship. Define augmented surface, and calculate it from the following data:

Mean of squares of sines of greatest obliquity.....	.0304
Mean of fourth powers of same.....	.0015
Length of load water-line.....	144 feet.
Length of mean immersed girth.....	19 "

Give rule for computing probable speed of a vessel.

8. State the principles of the wave-line theory. How is the length of entrance and of run found? What is the nature of the curves, and how are they constructed?

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE AND ARMOR.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—*Time allowed, four hours.*

1. Describe the process of casting hollow guns (Rodman's plan). Why cast hollow rather than solid?

2. Describe the method of obtaining tensile strength and specific gravity of metals.

3. Name the most improved guns in the American, English, and Prussian services, and state how they are constructed.

4. Give the weights of guns now in use in the United States service; also the weights of their projectiles.

5. How is the muzzle velocity of projectiles obtained? (Give the principle.)

6. Give the mode of fabrication of the Navy time-fuse and percussion-primer.

7. Give proportional ingredients of gunpowder, and state why it varies in size of grain, shape, density, &c.

8. Draw a profile of an earth-work; name the parts. Lay down the plan of a bastioned fort with four salients.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Name the functions of a slide-valve in the order in which they occur. State in which edge of valve each is performed.

Define *steam-lap*; *exhaust-lap*; *angular advance*; and specify their effects severally upon the functions.

2. Two engines furnished the given diagram. In one the clearance, &c., was .086 of the cylinder-capacity; in the other .025. State the actual degree of expansion in both cases, and the proportion of work done in each with equal volumes of steam.

3. What ratio exists between capacities of cylinder and condenser in an ordinary marine engine, and what weight of steam can be condensed per square foot of tube-surface per hour in practice?

4. What should be the capacity of a single-acting air-pump as compared with the steam-cylinder, and how does it differ from a double-acting one?

5. The diagram given was taken on Lake Erie from the single-acting air-pump of a jet-condenser while the engine was developing 465000 foot-pounds per revolution. What per centum of the total work is absorbed by the air-pump; diameter of pump-piston 17 inches?

6. Name the resistances a vessel encounters after having attained uniform speed, and state their relative importance.

7. State how the horse-power required for propulsion is governed by the section, displacement, and speed of a ship.

8. With engines developing 14 horse-power per revolution, having a propeller of 12 feet diameter and 22 feet pitch, what will be the total effort in pounds exerted by the propeller at its centre of pressure, and what the useful component or thrust, assuming that there is no loss between cylinder and propelling-instrument from friction, &c.?

9. Knowing the thrust of a screw, how calculate its efficiency?

10. According to what dimensions of a screw, and how, does the slip vary?

11. An engine of 3 feet stroke is making 60 revolutions per minute, which drives the ship at the rate of 11 knots per hour; it is desired to run at 7 knots per hour. What must be the number of revolutions per minute to accomplish this?

12. An engine ran two trips of 92 hours each; the revolutions and mean effective piston-pressure were exactly alike in both cases. In the first trip, anthracite coal was used, and, in the second, bituminous; in all other respects, the conditions were precisely similar.

The total number of thermal units in one pound of anthracite coal is 15225; in bituminous, 14700. The consumption of the former was at the rate of 10 pounds per square foot of grate per hour; of the latter, 20 pounds. Compare the work done in each case at the conclusion of the run.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

NAVIGATION.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—*Time allowed, five hours.*

THEORY OF NAVIGATION.

1. How find, by inspection, the Mercator's course and distance between two places whose latitudes and longitudes are given, and also the middle latitude, course, and distance?

2. Define variation of the compass, dip, parallax, semi-diameter, and augmentation of the moon's horizontal semi-diameter.

3. Deduce formulas (by Napier's and Bowditch's rules) for solving the astronomical triangle: 1st, to find the azimuth and altitude of a heavenly body, when its declination and hour-angle and the latitude of the observer are known; 2d, to find the latitude of the observer when the body's declination, hour-angle, and altitude are known.

4. Find formulas for the azimuth and for the hour-angle of a heavenly body when the three sides of the triangle are known.

5. Deduce the *versin* formulas for altitude and for latitude.

6. Deduce the formulas for the ordinary reduction to the meridian, the altitude being taken near the meridian.

7. Find the error in the latitude of an observer due to an error in the altitude, and also to an error in the hour-angle.

8. Find the error in the hour-angle due to an error in the altitude (Prestel), and also to an error in the declination (equal altitudes). In this last case, having found the amount of the error of the hour-angle on a particular day, how proceed to find the error of the chronometer on Greenwich mean time? Give a reason for the sign of application of the equation of time to the chronometer-time of apparent noon.

9. How convert sidereal time at any place into mean time? State one method in detail, and give reasons for the process.

10. Deduce formulas for finding the amplitude and hour-angle of a body when in the horizon, and for finding the hour-angle when the body is nearest to or on the prime-vertical at a given place.

THEORY AND PRACTICE OF NAVIGATION AND SURVEYING.

ANNUAL EXAMINATION.

JUNE, 1876.—Time allowed, five hours.

1. How adjust a transit-instrument very nearly in the meridian? How determine the collimation-constant?

2. Deduce the general formula for the "reduction to the meridian", illustrating by figure, and thence deduce Bessel's formula for computing the correction to be added to the observed sidereal clock-time of transit of a celestial body over the middle thread to obtain the clock-time of transit over the meridian.

3. In chart projections, what is the polyconic method? Describe the method of projecting a map of large extent on polyconic principles. What are x and y in the tables? State the advantages and disadvantages of the polyconic projection.

4. Describe the method of determining the astronomical bearing of a line of a survey, the sextant being used. Describe the method of running a line of soundings. Give two methods of fixing the position of a rock or shoal, and placing it upon the chart.

5. What are semicircular and quadrantal deviations of the compass, and to what causes are they due? Explain the causes of change in deviation of a ship's compass upon a change of geographical position. Which coefficients are affected by a change in geographical position? Which are not, and why are they not?

6. Describe fully the causes of the heeling error in iron ships, and state the positions of a ship with regard to the magnetic meridian in which the error will be greatest and least.

7. Required the deviation of the ship's compass for the ship's head on each of the points given in the second column of the appended table; also the deviations (approximately) when the ship's head is, by compass, at north and northeast by east.

Watch-hours—		Ship's head by standard compass.	Simultaneous bearings of—		Reading of theodolite pointed about some line, time 5h.
On board.	On shore.		Theodolite on shore by standard compass.	Compass on board by theodolite.	
4h. 32m. 0s. &c.	4h. 32m. 0s. &c.	N. N. E.	S. 43° 45' W.	142° 58'	
		E. N. E.	S. 20° 15' W.	194° 32'	
		E. S. E.	S. 22° 0' W.	131° 21'	
		S. S. E.	S. 2° 30' W.	106° 14'	
		S. S. W.	S. 27° 0' W.	154° 58'	
		W. S. W.	S. 29° 45' W.	122° 0'	
		W. N. W.	S. 66° 30' W.	153° 18'	
		N. N. W.	S. 88° 15' W.	181° 9'	

8. In question 7, the variation being $16^{\circ} 32'$ westerly, what is the true course made when the ship's head, by compass, is N. by E.? W. by S.? How head the ship, by compass, to make true course N. by E.? W. by S.? A light-house bears, by compass, N. $43^{\circ} 30'$ E., the ship's head being, by compass, S. by W. $\frac{1}{4}$ W.; what is the true bearing of the light-house?

Answers to questions 7 and 8 required in degrees and minutes.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT AND LIGHT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1876.—*Time allowed, five hours.*

1. What is meant by absolute temperature, and how does the use of absolute temperatures simplify the application of the laws of Boyle and Charles? Illustrate by an example.

2. What are the different methods used to measure quantities of heat?

3. What will be the result of mixing 5 kilogrammes of ice at 0° C., 1 kilogramme of water at 60° C., and $\frac{1}{2}$ kilogramme of steam at 100° C.?

4. Discuss the isothermals of steam and water between the temperatures 150° F. and 212° F., the pressure changing from $\frac{1}{2}$ atmosphere to 1 atmosphere.

5. Explain the reverse action of Carnot's engine, and show why it is impossible to transfer heat from a cold body to a hot one without the expenditure of mechanical work.

6. From the diagram deduce the four thermo-dynamic relations. (Diagram, p. 164, Maxwell's Theory of Heat.)

7. Derive a formula for determining heights by the barometer.

8. Explain the relations of the radiating and absorbing powers of solids and incandescent vapors.

9. What is the theory of the pressure of a gas?

10. Explain, by the molecular theory, the laws of Boyle and Charles.

11. What is meant by the angle of deviation produced in a ray of light by a prism? How is it used to determine the index of refraction?

12. Under what conditions are the dark lines of the solar spectrum visible? Explain the cause which produces them.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND
LAW.

LAW.

ANNUAL EXAMINATION.

JUNE 16, 1876.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

CONSTITUTION OF THE UNITED STATES.

1. With whom rests the power of impeachment? the power of trying impeachments? the power of trying cases of admiralty jurisdiction? of determining the rules of proceeding in either house of Congress? of originating bills for raising revenue? of defining and punishing offences against the law of nations? of appointing consuls? of admitting new States into the Union?

2. Describe the process by which a bill becomes a law.

State the provision in the Constitution in regard to (1) tonnage-duties; (2) export-duties; (3) unreasonable searches and general warrants; (4) religious tests.

INTERNATIONAL LAW.

3. Define or explain:—Natural law, right of redress, right of postliminy, embargo, reprisal, paper blockade.

Name and describe the ship's papers required by both international and municipal law.

3*. "International law knows only governments *de facto*." Explain.

Discuss the right of a state to the navigation of a river whose headwaters only lie within its territory.

4. Explain the relation of aliens to the government of the country in which they are sojourning.

State the rule as to the exemption of an ambassador from civil jurisdiction.

4*. Give a detailed account of the negotiations conducted by the United States Government in reference to the article of the Paris declaration (1856) on privateering, first through Secretary Marcy, and afterwards at the beginning of the late war.

5. What is the present usage of belligerents in regard to the treatment of irregular soldiers? of non-combatants? of private property? of public property? What is the usage as to requisitions?

5*. What is piracy? Where may pirates be tried? Distinguish between piracy by international law and acts which are made piracy by statute.

6. Discuss the limits of the right of search in the case of neutrals under (1) belligerent convoy, (2) neutral convoy.

6*. What is due notice of a blockade? What is the penalty for a breach of blockade? How far was the doctrine of continuous voyages applied by our courts during the late war to breaches of blockade?

7. What, in general, is a competent court for determining a question of prize? What courts have cognizance of these questions in Great Britain? in the United States? What can you say of the place of the court?

7*. Explain contraband.

Discuss the principle of "occasional contraband". Explain the practice of pre-emption as applied to contraband goods.

8. In case of a war between the United States and France, in command of the United States ship *Constellation* cruising in the West Indies, you recapture an American brig, having on board a prize-crew, from her captor, the Insurgente, and bound to

Martinique for adjudication. Describe all the consequences of the recapture, state what you do with the prize, and what becomes of her finally; in general, how all parties are affected, giving reasons.

9. Some days later, you capture a barque owned in Bahia, and engaged in carrying contraband to France. She is taken into port and condemned on that ground. It appears that she was originally an American vessel, but was captured early in the war by the French, condemned as enemy's property, and sold to a Brazilian firm. The original owner puts in a claim. How is it to be decided?

10. Next day you search a Dutch (neutral) brig, bound from Guadalupe to Copenhagen. You discover a packet addressed to the French ambassador at Copenhagen from the governor of the island. The master does not voluntarily disclose the packet nor does he practise any fraud. What would you do? What consequences would flow from your act?

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, four hours.*

1. Give the formulas for direct crushing; for crushing by bending, as in the cases of a connecting-rod and of a piston-rod. Explain manner of using, and give values of constants.

2. What will be the safe working-pressure of a boiler (cylindrical) of the following dimensions; diameter, 4'; length, 16'; thickness of shell, $\frac{5}{16}$ "; seams double-riveted? Through this boiler passes an elliptical flue $36'' \times 15'' \times \frac{5}{8}$ ", and of the same length as the boiler. What pressure will it stand with safety, and how and where can it be made equally strong with the shell?

3. Discuss the subject of spherical shells as applied to the ends of cylindrical boilers, tops of steam-domes, &c.

4. Discuss the subject of chimney-draught, giving formulas for velocity of current, density of mixed gases, and head required to produce the draught.

5. Given anthracite coal of the components C, 0.915; H, 0.035; and O, 0.026: require the weight of pure carbon whose total heat of combustion shall equal that of the fuel, the theoretical evaporative power in pounds of water from and at 212° Fah., and the number of pounds of air required for combustion per pound of fuel.

6. Define efficiency of heating-surface. Assuming Peclet's formula for the thermal resistance of the plates, viz: $q = A(T-t) \left\{ 1 + B(T-t) \right\}$, find an expression for the efficiency from the following data:

W , weight of gas given out by the furnace per hour;

c , its specific heat at constant pressure;

T , its temperature, whose value is T_1 at first contact and T_2 at last;

t , temperature of the water in the boiler;

ds , area of surface in contact with the fluids $\left(\int ds = S \right)$;

q , rate of conduction per square foot per hour; and

$\frac{S}{W} = \int_{T_2}^{T_1} \frac{dT}{P}$, the equation of reference.

7. What is a calorimeter? Describe different kinds in general use.

8. What relation exists between the pressure and density of vapors? What formula is used for calculating the pressure from the temperature of the boiling-point?

9. Define specific heat. The specific heat of water at any temperature T being given by the formula $c = 1 + 0.000000309(T - 32.1)^2$, it is required to find the mean specific heat between any given pair of temperatures T_1 and T_2 .

10. What is meant by absolute zero? How is it determined? Find the absolute temperatures of melting ice, and of water boiling under the pressure of one atmosphere in the Réaumur, Centigrade, and Fahrenheit scales.

DESIGNING MACHINERY.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Give the lengths, in feet, of the fore and the after body of a steam-vessel whose speed is to be 14 knots per hour.

2. Give the indicated horse-power for a vessel, according to Rankin's method, from the following data:

Mean of squares of sines of angles of greatest obliquity	0.0223
Mean of 4th powers of sines of angles of greatest obliquity	0.0008
Length on water-line	300 feet.
Length of mean immersed girth	40 feet.
Speed, in knots	17
Coefficient of propulsion	21502

3. The space in clearance and passages being 8 per centum of the space displaced by the piston, give a formula that will express the measure of expansion actually effected, the point of cutting off being half-stroke.

4. Give the diameters of the two cylinders for a compound engine of 1000 indicated horse-power. Data: stroke, 3 feet; revolutions per minute, 50; boiler-pressure per square inch (absolute), 78 pounds; back pressure, 3 pounds per square inch; total measure of expansion, 5.

5. Given diameter of cylinder 60 inches, stroke 36 inches, revolutions per minute 50, what should be the width of the steam-ports, their length being 46 inches? What should be the width of the exhaust-port?

6. Discuss the Zeuner valve diagram in its application to the action of the simple slide-valve. Give an example showing how the lap and travel of the valve can be ascertained when the point of cutting off and angle of lead are known.

7. Design a gridiron expansion-valve: the ports of the main valve to be 4 inches wide; the cut-off valve to have two ports, and the openings in the valve to be $\frac{1}{2}$ inch wider than those in the seat; to cut off at $\frac{1}{2}$ stroke, and have no angular advance; the main valve to admit steam when the piston is $\frac{1}{2}$ inch from the beginning of its stroke. What should be the travel of the cut-off valve, and what amount of steam-lap should be placed on the main valve to prevent a re-admission of steam before the stroke is completed?

Give also the minimum distance between the ports of the cut-off valve. Make stroke of piston 4 feet.

8. In question (7.) what must be the length of the cylinder?

9. Upon what does the breadth of the piston-ring face depend? How is the friction of the piston counteracted in horizontal engines? What should determine the employment of any remedy for excessive friction?

10. Give the thickness of a cylindrical boiler-shell, 10 feet in diameter, for a pressure of 80 pounds per square inch, per gauge. Give also the grate and heating surfaces, and the calorimeter, in square feet, required for the evaporation of 1000 pounds of water per hour.

INDEX.

- ical Board, 11.
 ion of Cadet-Midshipmen, Exam-
 on for, 42.
 ion of Cadet-Midshipmen, Regula-
 governing, 42.
 ion of Cadet-Engineers, Examina-
 for, 51.
 ion of Cadet-Engineers, Regula-
 governing, 51.
 1, Course in, 56.
 1, Examination for admission in,
 t-Engineers, 52.
 1, examination-papers, 62, 63, 64, 65.
 etic, Examination for admission in,
 49, 52.
 y-drills, 55.
 omy, Course in, 56.
 omy, examination-paper, 85.
 , Instruction in, 55.
 Engineer, Admission of, 28.
 officers, 11.
 s, Course in, 57.
 s, examination-papers, 75, 76, 86.
 ur, Academic, 6.
 ur, Civil, 7.
 try, Course in, 57.
 try, examination-papers, 77.
 ents, Table of, 32.
 itive examination for admission of
 -Engineers, 52.
 lation, Officers and Cadet-Midship-
 U. S. S., 30.
 of instruction, 55.
 Practice, 30.
 g, Instruction in, 55.
 28.
 it, Sections of fourth class, 1875-76,

 on admission, 46.
 als, 28.
 g, Course in, 58.
 55.
 e courses, 33, 56, 58.
 ity, examination-papers, 86.
 , Course in, 58.
 , examination-papers, 68, 69.
 ation-papers, 1875-76, 62.
 28, 46.
 ; Instruction in, 55.

 First class, Cadet-Midshipmen, relative
 standing, 14.
 First class, Cadet-Midshipmen, 1875-76,
 merit-roll, 34.
 First class, Cadet-Engineers, relative stand-
 ing, 23.
 First class, Cadet-Engineers, 1875-76,
 merit-roll, 40.
 Fourth class, Cadet-Midshipmen, 21.
 Fourth class, Cadet-Midshipmen, 1875-76,
 merit-roll, 39.
 Fourth class, Cadet-Engineers, 23.
 Fourth class, Cadet-Engineers, 1875-76,
 merit-roll, 41.
 French, Course in, 52.
 French, Examination-papers in, 70, 79, 83.
 Geography, Examination for admission
 in, 45, 48, 50, 54.
 Geometry, Course in, 56.
 Geometry, Examination for admission in,
 Cadet-Engineers, 53.
 Geometry, examination-paper, 65.
 Geometry, Analytical, examination-papers,
 74.
 Graduating class, relative standing, Cadet-
 Midshipmen, 12.
 Graduating class, relative standing, Cadet-
 Engineers, 23.
 Grammar, Examination for admission in,
 44, 48, 49, 54.
 Gunnery, Course in, 55.
 Gunnery, examination-paper, 93.
 Gymnastics, Instruction in, 55.
 Heat, examination-paper, 96.
 Historical sketch, 4.
 History, Course in, 52.
 History, examination-papers, 67, 68.
 Japan, Students from, 26.
 Law, Course in, 55.
 Law, examination-paper, 97.
 Marine engines, examination-papers, 94,
 99, 100.
 Marine garrison, Officers of, 10.
 Mates, 10.
 Mayflower, U. S. S., Officers and
 Engineers of, 31.
 Mechanics, Course in, 57.
 Mechanics, examination-papers, 87.
 Merit-rolls, Explanation of, 33.

- Mortar-practice, 55.
 Natural philosophy, Examination for admission in, 53.
 Naval architecture, examination-paper, 93.
 Naval construction, Course in, 55.
 Navigation, Course in, 57.
 Navigation, examination-papers, 94, 95.
 Officers of the Naval Academy, 8.
 Officers not attached to the Academic Staff, 10.
 Physics, Course in, 57.
 Physics, Examination-papers in, 76, 77.
 Programme of studies, 59.
 Resignations, 27.
 Resignations, Acceptance of, revoked, 28.
 Rhetoric, Course in, 58.
 Rhetoric, examination-papers, 78, 79.
 Rifle-match, 29.
 Seamanship, Course in, 55.
 Seamanship, examination-papers, 83, 90.
 Second class, Cadet-Midshipmen, relative standing, 16.
 Second class, Cadet-Midshipmen, 1875-76, merit-roll, 36.
 Second class, Cadet-Engineers, relative standing, 23.
 Ship-building, examination-paper, 81.
 Signals, Exercises in the use of, 55.
 Spanish, Course in, 58.
 Spanish, examination-paper, 89.
 Spelling, Examination for admission 46, 48, 50, 54.
 Staff, Academic, 8.
 Steam-engineering, Course in, 56.
 Summary, 26.
 Surveying, Course in, 57.
 Swimming, Instruction in, 55.
 Tactics, Course in, naval and infantry.
 Tactics, examination-papers, infantry.
 Tactics, examination-papers, naval, 82.
 Text-books, 55, 56, 57, 58.
 Theme periods, 60, 61.
 Third class, Cadet-Midshipmen, relative standing, 18.
 Third class, Cadet-Midshipmen, 1875-76, merit-roll, 38.
 Third class, Cadet-Engineers, 1875-76, merit-roll, 40.
 Travelling expenses, 46.
 Trigonometry, Course in, 56.
 Trigonometry, examination-papers, 71, 73.
 Visitors, Board of, 5.
 Withdrawn, 28.

415
H3
STORGE
4th

ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

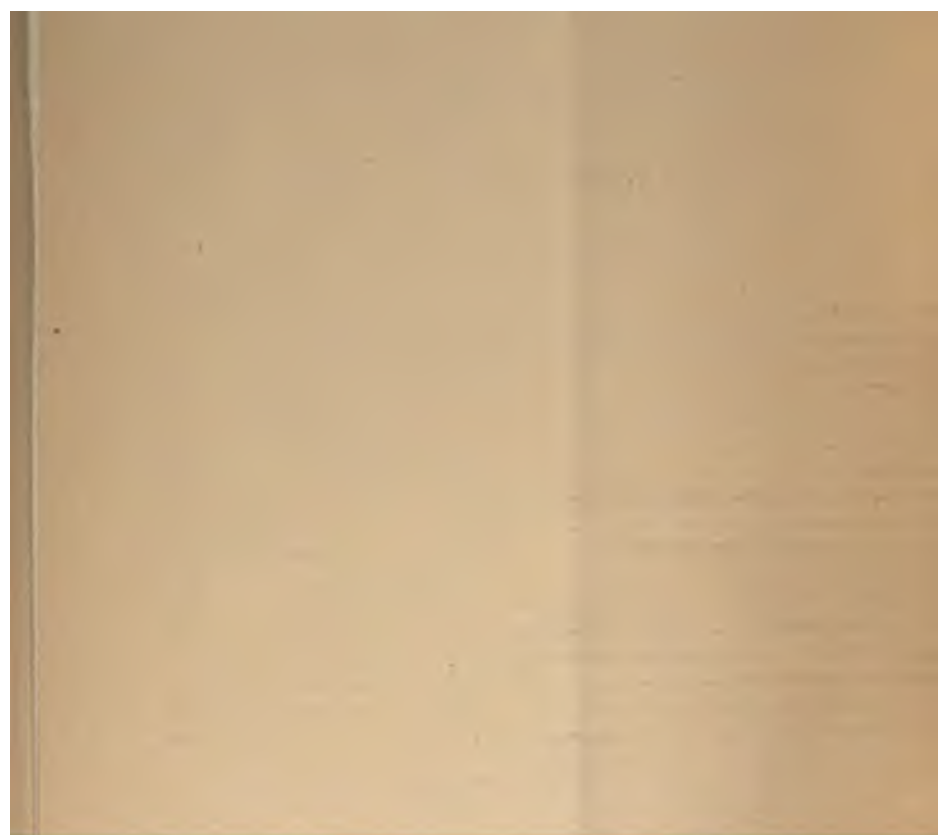
ANNAPOLIS, MD.

TWENTY-EIGHTH ACADEMIC YEAR,

1877-78.



WASHINGTON:
GOVERNMENT PRINTING OFFICE:
1877.



CONTENTS.

	Page.
Historical Sketch	4
Number of Visitors	5
Annual Calendar	6
Calendar, 1877-78	7
Teachers	8
Advisory Board	11
Faculty	11
Students, with Relative Standing in Classes	12
Historical Summary	27
Admissions, Dismissals, and Deaths	28
Annual Rifle-Match	30
Excursion-Cruise, 1877	31
Table of Coefficients	33
Enrollment, 1876-77	35
Admission Requirements	45
System of Instruction	51
Programme of Studies	55

THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by Hon. George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The course was fixed at five years, of which the first and last only were spent at the School, the intervening three being passed at sea. This arrangement was not strictly adhered to, the exigencies of the service making it necessary, in many cases, to shorten the period of study. In January, 1846, four months after the opening of the School, the students consisted of 36 Midshipmen, of the date of 1840, who were preparing for the examination for promotion; 13 of the date of 1841, who were to remain until drafted for service at sea; and 7 Acting Midshipmen, appointed since September of the previous year. The Midshipmen of the date of 1840 were the first to graduate, finishing their limited course in July, 1846, and they were followed in order by the subsequent dates, until the reorganization of the School, in 1851.

In September, 1849, a Board was appointed to revise the plan and regulations of the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. DuPont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation July 1, 1850.

The new organization provided for a course of seven years, the first two and last two at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, and its name was changed to the United States Naval Academy. The corps of professors was enlarged, the course was extended, and the system of separate departments, with executive heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Secretary of the Navy. A suitable vessel was attached to the Academy as a practice-ship, and the annual practice-cruises were begun.

After the system had been in operation a year new changes were proposed, and the recommendations of the Academic Board on the subject were referred to the Board of Examiners of the year 1851, composed of the following officers:

Commodore David Conner,
Captain Samuel L. Breese,
Commander C. K. Stribling,
Commander A. Bigelow,
Commander Franklin Buchanan,
Lieutenant Thomas T. Craven.

The change recommended by the Board of Examiners, and adopted by the Department, consisted mainly in leaving out the requirement of three years of sea-service in

the middle of the course, thus making the four years of study consecutive. The practice-cruises supplied the place of the omitted sea-service, and gave better opportunities of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in three years, and graduated in June, 1854; the rest of the class followed in 1855.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the Frigates *Constitution* and *Santee*. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department; the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years, instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

BOARD OF VISITORS, JUNE, 1877.

Commodore J. W. A. NICHOLSON, U. S. N., *President*.
Brigadier General W. H. EMORY, U. S. A., *Vice-President*.
General R. P. BUCKLAND, of Ohio.
Rt. Rev. W. I. KIP, D. D., LL. D., Bishop of California.
Professor W. G. HAMMOND, Iowa State University.
Professor I. F. QUINBY, of New York.
Captain S. R. FRANKLIN, U. S. N.
Pay-Director J. C. ELDREDGE, U. S. N.
Honorable L. C. HOUK, of Tennessee.
Honorable J. A. LEONARD, of Minnesota.
Chief-Engineer J. P. SPRAGUE, U. S. N.
Medical-Director F. M. GUNNELL, U. S. N.
Honorable C. A. CURTIS, of Massachusetts.

ACADEMIC CALENDAR.

1877-78.

1877.

Sept. 20.—Beginning of first term Thursday.

1878.

Jan. 28-Feb. 2.—Semi-annual examination Monday-Saturday.

Feb. 2.—End of first term Saturday.

June 10-20.—Annual examination Monday-Thursday

June 20.—End of academic year 1877-78 Thursday.

June 21.—Examination of candidates for admission as Cadet-Midshipmen Friday.

Sept. 5.—Examination of candidates for admission as Cadet-Engineers Thursday.

Sept. 12.—Examination of candidates for admission as Cadet-Midshipmen Thursday.

Sept. 20.—Beginning of first term 1878-79 Friday.

The academic months end on the following days:

1877-78.

October	Oct. 27	February	Mar. 6
November	Nov. 24	March	April 6
December	Dec. 22	April	May 4
January	Jan. 26	May	June 1

1878-79.

October	Oct. 26	February	Mar. 5
November	Nov. 23	March	April 5
December	Dec. 21	April	May 3
January	Jan. 25	May	June 7

CALENDAR FOR 1877-78.

SEPTEMBER.							MARCH.						
Sun.	M.	T.	W.	T.	F.	Sat.	Sun.	M.	T.	W.	T.	F.	Sat.
-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1	2
2	3	4	5	6	7	8	3	4	5	6	7	8	9
9	10	11	12	13	14	15	10	11	12	13	14	15	16
16	17	18	19	20	21	22	17	18	19	20	21	22	23
23	24	25	26	27	28	29	24	25	26	27	28	29	30
30	-----	-----	-----	-----	-----	-----	31	-----	-----	-----	-----	-----	-----
OCTOBER.							APRIL.						
-----	1	2	3	4	5	6	-----	1	2	3	4	5	6
7	8	9	10	11	12	13	7	8	9	10	11	12	13
14	15	16	17	18	19	20	14	15	16	17	18	19	20
21	22	23	24	25	26	27	21	22	23	24	25	26	27
28	29	30	31	-----	-----	-----	28	29	30	-----	-----	-----	-----
NOVEMBER.							MAY.						
-----	-----	-----	-----	1	2	3	-----	-----	1	2	3	4	-----
4	5	6	7	8	9	10	5	6	7	8	9	10	11
11	12	13	14	15	16	17	12	13	14	15	16	17	18
18	19	20	21	22	23	24	19	20	21	22	23	24	25
25	26	27	28	29	30	-----	26	27	28	29	30	31	-----
DECEMBER.							JUNE.						
-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1	-----
2	3	4	5	6	7	8	2	3	4	5	6	7	8
9	10	11	12	13	14	15	9	10	11	12	13	14	15
16	17	18	19	20	21	22	16	17	18	19	20	21	22
23	24	25	26	27	28	29	23	24	25	26	27	28	29
30	31	-----	-----	-----	-----	-----	30	-----	-----	-----	-----	-----	-----
JANUARY.							JULY.						
-----	-----	1	2	3	4	5	-----	1	2	3	4	5	6
6	7	8	9	10	11	12	7	8	9	10	11	12	13
13	14	15	16	17	18	19	14	15	16	17	18	19	20
20	21	22	23	24	25	26	21	22	23	24	25	26	27
27	28	29	30	31	-----	-----	28	29	30	31	-----	-----	-----
FEBRUARY.							AUGUST.						
-----	-----	-----	-----	-----	1	2	-----	-----	-----	-----	1	2	3
3	4	5	6	7	8	9	4	5	6	7	8	9	10
10	11	12	13	14	15	16	11	12	13	14	15	16	17
17	18	19	20	21	22	23	18	19	20	21	22	23	24
24	25	26	27	28	-----	-----	25	26	27	28	29	30	31

OFFICERS
OF THE
UNITED STATES NAVAL ACADEMY.

REAR ADMIRAL C. E. P. RODGERS,
SUPERINTENDENT.

COMMANDER S. D. GREENE,
Senior Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER EDWARD TERRY,
Commandant of Cadets.

LIEUTENANT-COMMANDER B. H. MCCALLA,
Assistant to the Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER H. L. HOWISON,
Head of Department.

LIEUTENANT-COMMANDER C. V. GRIDLEY,
LIEUTENANT W. H. EMMOT,
LIEUTENANT L. C. LOGAN,
LIEUTENANT A. P. OSBORN,

Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,

Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER A. T. MAHAN,
Head of Department.

LIEUTENANT-COMMANDER MERRILL MILLER,
In charge of practice-ships.

LIEUTENANT J. C. SOLEY,
LIEUTENANT DUNCAN KENNEDY,
LIEUTENANT T. B. MASON,
LIEUTENANT A. V. WADHAMS,

Instructors in Naval Gunnery, and Infantry Tactics.

ANTOINE J. CORRESIER,
Sword-Master.

JEAN B. RETZ,
GEORGE HEINTZ,

Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR W. W. HENDRICKSON,

Head of Department.

LIEUTENANT-COMMANDER C. W. KENNEDY,
 LIEUTENANT SOPHOCLES HUBBARD, A. M.,
 LIEUTENANT J. H. DAYTON,
 LIEUTENANT C. S. SPERRY,
 LIEUTENANT C. C. CORNWELL,
 LIEUTENANT R. R. INGERSOLL,
 MASTER H. O. RITTENHOUSE,
 MASTER G. L. DYER,
 ENSIGN T. B. HOWARD,

Instructors in Mathematics.

STEAM-ENGINEERING.

CHIEF ENGINEER C. H. BAKER,

Head of Department.

PASSED ASSISTANT ENGINEER L. W. ROBINSON, C. E., M. M. E.,
 PASSED ASSISTANT ENGINEER C. H. GREENLEAF,
 PASSED ASSISTANT ENGINEER W. L. NICOLL,
 PASSED ASSISTANT ENGINEER DAVID JONES,
 PASSED ASSISTANT ENGINEER C. H. MANNING,
 PASSED ASSISTANT ENGINEER ROBERT CRAWFORD,
 PASSED ASSISTANT ENGINEER C. W. RAE, C. E.,

Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

COMMANDER J. A. HOWELL,

Head of Department.

LIEUTENANT-COMMANDER A. D. BROWN,
 LIEUTENANT R. M. G. BROWN,
 LIEUTENANT C. G. BOWMAN,

Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

COMMANDER W. T. SAMPSON,

Head of Department.

LIEUTENANT-COMMANDER T. F. JEWELL,
 ENSIGN A. A. MICHELSON,
 PROFESSOR N. M. TERRY, A. M., PH. D.,
 PROFESSOR C. E. MURDOCK, S. B.,

Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR J. M. RICE, S. B.,

Head of Department.

LIEUTENANT M. R. S. MACKENZIE,
 LIEUTENANT S. W. VERY,
 LIEUTENANT HARRY KNOX,

Instructors in Mechanics and Applied Mathematics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR J. R. SOLEY, A. B.,

Head of Department.

LIEUTENANT J. M. MILLER,
 LIEUTENANT J. F. MEIGS,
 LIEUTENANT F. M. WISE,
 LIEUTENANT R. T. JASPER,
 LIEUTENANT W. P. POTTER,
 LIEUTENANT J. B. BRIGGS,
 ENSIGN A. M. KNIGHT,
 ASSISTANT PROFESSOR W. W. FAY, A. M.

Instructors in English Studies, History, and Law.

10 OFFICERS OF THE UNITED STATES NAVAL ACADEMY.

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,

Head of Department.

LIEUTENANT R. C. DERRY,
LIEUTENANT A. P. NAZRO,
MASTER AARON WARD,
MASTER W. P. CLASON,
ASSISTANT PROFESSOR A. V. S. COURCELLE,
ASSISTANT PROFESSOR EUGENE DOTILJERS,
ASSISTANT PROFESSOR JULES LEROUX,
ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,

Head of Department.

ENSIGN H. F. REICH,
ASSISTANT PROFESSOR C. F. BLAUVELT, N. A.,

Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

MEDICAL INSPECTOR A. L. GIHON, A. M., M. D.
PASSED ASSISTANT SURGEON W. A. CORWIN, M. D.
PASSED ASSISTANT SURGEON G. E. HARMON, M. D.
ACTING ASSISTANT SURGEON T. O. WALTON, M. D.
PAYMASTER A. S. KENNY, A. B., *Commissary.*
PAYMASTER W. N. WATMOUGH,
PAYMASTER S. T. BROWNE, *Storekeeper.*
CHAPLAIN ROBERT HUDSON, M. A.
ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
J. J. GRAFF, *Assistant Librarian.*
R. M. CHASE, *Secretary.*

J. G. GLYNN, *First Clerk.*
SAMUEL JICKLING, *Second Clerk.*
C. M. MCLEOD, *Clerk to Commandant of Cadets.*
EUGENE WORTHINGTON, *Third Clerk to Superintendent.*

MARINE GARRISON.

CAPTAIN G. P. HOUSTON, *Commanding.*
FIRST LIEUTENANT W. N. MUSE.
FIRST LIEUTENANT J. M. T. YOUNG.
FIRST LIEUTENANT A. C. KELTON.
SECOND LIEUTENANT S. H. GIBSON.

GUNNER.

ROBERT SOMMERS.

MATES.

C. J. MURPHY	} Attached to the United States Gunnery-ship Sand and to the Sloop-of-war Dale.
SAMUEL GEE	
WILLIAM G. SMITH	
L. M. MELCHER	
ROBERT SILVER	} Attached to United States Steamer Nantucket (iron clad.)
BENJAMIN G. PERRY	
JOSEPH RODGERS	} Attached to the United States Steamer Phlox (steam tender.)

ACADEMIC BOARD.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N.
 COMMANDER EDWARD TERRY, U. S. N.
 COMMANDER J. A. HOWELL, U. S. N.
 COMMANDER H. L. HOWISON, U. S. N.
 COMMANDER A. T. MAHAN, U. S. N.
 COMMANDER W. T. SAMPSON, U. S. N.
 CHIEF ENGINEER C. H. BAKER, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 PROFESSOR J. M. RICE, S. B., U. S. N.
 PROFESSOR J. R. SOLEY, A. B., U. S. N.
 PROFESSOR L. F. PRUD'HOMME, A. M.
 PROFESSOR MARSHAL OLIVER.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER.

J. H. FILLMORE.

CADET-LIEUTENANTS.

S. RODGERS. C. S. McCLAIN. J. G. QUINBY. W. L. RODGERS.

CADET-MASTERS.

S. KNAPP. R. C. SMITH. H. McL. P. HUSE. EDWARD LLOYD.
 P. B. BIBB, *Adjutant*.

CADET-ENSIGNS.

G. GLENNON. F. J. SPRAGUE. J. H. L. HOLCOMBE. S. F. BIDDLE.

First Captains of Gun's Crews.

A. C. Almy.	J. E. McDonnell.	A. G. Rogers.	J. H. Shipley.
E. K. Wright.	J. E. Craven.	G. R. Clark.	B. C. Dent.
W. C. Canfield.	T. W. Ryan.	G. Sparhawk.	G. H. Stafford.
C. N. Atwater.	J. J. Knapp.	G. F. Ormsby.	J. H. Hetherington.

Second Captains of Gun's Crews.

W. L. Todd.	H. H. Hooke.	John Hood.	Harvey Wike.
W. P. White.	A. B. Clements.	H. S. Chase.	C. C. Marsh.
Prentice Bailey.	R. H. Miner.	J. M. Moore.	J. S. Sloan.
Harry Kimmell.	E. E. Hayden.	L. M. Garrett.	C. W. Jungen.

CADET-PASSED-ASSISTANT-ENGINEER.

I. N. HOLLIS.

CADET-ASSISTANT-ENGINEERS.

F. J. Schell. M. E. Cooley.

Cadet-Machinists.

H. W. Spangler.	G. W. McElroy.	F. C. Bleg.	J. L. Gow.
J. H. Bull.	R. S. Griffin.	F. W. Bartlett.	C. L. Wight

CADET-MIDSHIPMEN.

Graduating class of 1877—45 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.			Order of merit in—							Sea-service in practice-ships.		Number of demerits.
				Years.	Months.	Days.	S Seamanship.	Naval construction.	Ordnance.	Marine engines.	Navigation.	Light and Heat.	Law.	Spanish.	Months.	Days.
1	Fullam, William Freeland	New York	Sept. 24, 1873	17	11	3	2	1	1	3	5	2	4	9	5	27
2	Witzel, Horace Mark	Wisconsin	June 5, 1873	15	4	4	1	2	1	1	1	1	3	12	5	27
3	Dodge, Orenzo George	Kansas	June 13, 1873	17	0	1	6	6	4	4	4	3	8	29	122	5
4	David, William Glenn	New York	Sept. 25, 1873	17	2	5	3	5	8	8	7	4	2	7	110	5
5	Winterhalter, Albert Gustavus	Michigan	Sept. 22, 1873	16	11	10	4	22	26	3	3	12	1	1	5	27
6	Jeffries, Alfred	Texas	June 9, 1873	17	9	2	5	2	13	13	13	13	29	4	23	5
7	Orchard, John Madison	Missouri	June 11, 1873	15	9	22	11	9	7	9	11	26	16	165	5	27
8	Bronaugh, William Venable	Kentucky	June 5, 1873	17	9	10	14	18	10	8	7	7	34	73	5	26
9	Patla, Euseb Clark	New York	Sept. 23, 1873	14	1	34	7	27	10	2	8	26	2	138	5	27
10	Taylor, Hiero	Illinois	Sept. 22, 1873	17	0	35	15	22	6	12	10	17	15	71	5	27
11	Jordan, John Newell	Maine	June 5, 1873	17	8	6	16	7	5	11	6	14	10	97	5	27
12	Fechter, Augustus Francis	New York	June 5, 1873	15	9	18	8	18	26	6	14	15	8	104	5	27
13	Brimby, Thomas Mason	Georgia	Sept. 26, 1873	17	10	9	12	7	6	18	9	8	25	87	5	27
14	Brice, Jonathan Kearney	Ohio	June 13, 1873	17	8	16	9	13	2	10	5	23	35	146	5	27
15	Wright, Edward Everett	Massachusetts	Sept. 20, 1873	17	0	23	23	17	39	16	23	10	16	117	5	27
16	Bostwick, Frank Matteson	Wisconsin	Sept. 26, 1873	16	5	22	37	18	26	21	26	16	18	143	5	27
17	Woodworth, Selim Edward	At large	Sept. 30, 1872	15	5	14	10	4	24	32	33	11	3	89	9	13
18	Gleaves, Albert	Tennessee	June 13, 1873	15	5	13	10	1	38	24	12	25	10	86	5	27
19	Constant, Walter Malles	Indiana	June 13, 1873	16	3	16	19	25	14	19	24	19	32	78	5	27
20	Selmon, Valentine Scryer	Tennessee	June 6, 1873	17	5	7	10	22	36	34	15	19	13	117	5	27
21	O'Brien, James Harrison	Georgia	June 12, 1873	16	9	27	40	26	33	36	16	20	2	106	5	27

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,

Head of Department.

LIEUTENANT R. C. DERRY,
LIEUTENANT A. P. NAZRO,
MASTER AARON WARD,
MASTER W. P. CLASON,
ASSISTANT PROFESSOR A. V. S. COURCELLE,
ASSISTANT PROFESSOR EUGENE DOVILLIERS,
ASSISTANT PROFESSOR JULES LEROUX,
ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,

Head of Department.

ENSIGN H. F. REICH,
ASSISTANT PROFESSOR C. F. BLAUVELT, N. A.,

Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

MEDICAL INSPECTOR A. L. GIHON, A. M., M. D.
PASSED ASSISTANT SURGEON W. A. CORWIN, M. D.
PASSED ASSISTANT SURGEON G. E. HARMON, M. D.
ACTING ASSISTANT SURGEON T. O. WALTON, M. D.
PAYMASTER A. S. KENNY, A. B., *Commissary.*
PAYMASTER W. N. WATMOUGH.
PAYMASTER S. T. BROWNE, *Storekeeper.*
CHAPLAIN ROBERT HUDSON, M. A.
ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
J. J. GRAFF, *Assistant Librarian.*
R. M. CHASE, *Secretary.*

J. G. GLYNN, *First Clerk.*
SAMUEL JICKLING, *Second Clerk.*
C. M. MCLEOD, *Clerk to Commandant of Cadets.*
EUGENE WORTHINGTON, *Third Clerk to Superintendent.*

MARINE GARRISON.

CAPTAIN G. P. HOUSTON, *Commanding.*
FIRST LIEUTENANT W. S. MUNE.
FIRST LIEUTENANT J. M. T. YOUNG.
FIRST LIEUTENANT A. C. KELTON.
SECOND LIEUTENANT S. H. GIBSON.

GUNNER.

ROBERT SOMMERS.

MATES.

C. J. MURPHY	} Attached to the United States Gunnery-ship <i>Santee</i> and to the Sloop-of-war <i>Dale</i> .
SAMUEL GEE	
WILLIAM G. SMITH	
L. M. MELCHER	
ROBERT SILVER	} Attached to United States Steamer <i>Nantucket</i> (iron- clad.)
BENJAMIN G. PERRY	
JOSEPH RODGERS	

} Attached to the United States Steamer *Phlox* (steam-
tender.)

		June 12, 1874	14	10	6	4	8	12	3	9	0	20	14	13	143	5	18
14	Quincy, John Gardner	At large	14	10	6	4	8	12	3	9	0	20	14	13	143	5	18
15	Rodgers, Thomas Sildell	At large	10	1	4	9	10	1	2	4	3	1	1	1	137	0	18
16	Rodgers, William Leelyard	California	14	4	8	19	6	7	8	8	6	7	16	20	139	5	7
25	Rogers, Allan Grey	North Carolina	14	6	20	96	15	35	32	21	23	31	26	24	175	0	18
21	Ryan, Thomas William	Pennsylvania	16	11	21	20	31	34	26	19	22	15	19	21	188	7	26
26	Shipley, John Harry	Missouri	16	6	28	23	23	26	31	29	31	26	30	33	153	5	18
9	Smith, Roy Campbell	Virginia	16	2	16	7	17	4	4	10	10	6	7	18	53	0	18
24	Sparhawk, George	Massachusetts	17	6	23	33	28	11	20	34	31	30	23	22	163	5	18
10	Sprague, Frank Julian	Massachusetts	17	9	18	5	5	19	6	3	8	14	21	23	173	5	18
33	Stafford, George Henry	Iowa	17	11	24	8	24	16	15	27	37	8	25	26	105	5	18
27	Todd, Wilson Louuel	Pennsylvania	15	1	34	12	29	17	18	24	31	28	33	31	212	3	18
32	White, William Porter	At large	15	5	20	17	24	10	23	16	13	37	31	35	175	5	18
11	Wood, Albert Noron	Indiana	16	6	2	2	4	12	9	13	11	24	29	12	49	5	26
18	Wright, Robert Kemp	Pennsylvania	14	8	7	22	26	8	11	22	24	9	17	11	131	7	26

16 CADET-MIDSHIPMEN, SECOND CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN.
Second class—44 members.

Order of annual merit	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.			Months.	Days.
12	Bailey, Prentice	Georgia	Sept. 28, 1874	17	1	10	16	18	18	28	199	3	0	
20	Barnard, Louis Hull	Colorado	June 13, 1874	16	11	30	38	12	13	39	79	2	19	
24	Bell, John Arthur	West Virginia	June 13, 1874	16	11	21	16	29	32	99	143	2	19	
43	Bitler, Reuben Oscar	Pennsylvania	June 19, 1875	16	1	40	47	39	30	13	171	2	19	
15	Bliss, John Bell	Indiana	Sept. 15, 1875	15	0	15	12	26	9	46	140	2	19	
39	Brown, Guy Warner	Indiana	June 19, 1875	17	3	36	34	33	47	17	60	2	19	
52	Buchanan, Wilson Wildman	Ohio	June 19, 1875	17	6	13	23	14	29	16	137	2	19	
16	Caboon, James Blake	Vermont	June 10, 1874	17	10	6	1	11	6	7	154	2	19	
5	Chase, Henry Sanders	Louisiana	June 21, 1875	17	6	1	2	6	22	9	134	2	19	
41	Clements, Abner Brush	Missouri	June 9, 1874	16	4	33	30	30	27	10	66	2	19	
22	Cunningham, Andrew Chase	New York	June 9, 1874	16	9	23	15	30	29	14	84	2	19	
23	Dougherty, John Allen	Missouri	June 12, 1874	16	9	23	15	30	29	14	84	2	19	
44	Drayton, Percival Langdon	At large	June 10, 1874	16	2	45	42	45	4	20	293	2	19	
36	Garrett, Leigh Osborn	Illinois	Sept. 13, 1875	15	1	18	40	24	26	13	162	2	19	
7	Garrett, Le Roy Mason	New York	Sept. 16, 1875	18	0	7	13	8	5	4	66	2	19	
29	Gibbons, John Henry	Michigan	Sept. 13, 1875	16	8	37	31	9	18	41	240	2	19	
18	Gibson, John	Kentucky	Feb. 16, 1874	18	0	16	14	34	33	12	66	2	19	
13	Gill, William Andrew	Pennsylvania	June 21, 1875	16	5	17	7	17	23	29	199	2	19	
25	Gorgas, Miles Carpenter	At large	Sept. 11, 1875	14	2	27	35	37	3	19	51	2	19	
40	Gravano, William Alfred	New York	Sept. 28, 1874	14	11	42	32	40	40	33	224	2	19	
17	Harlow, Charles Henry	New York	Sept. 15, 1875	17	0	18	11	10	14	39	160	2	19	
7	Hayden, Edward Everett	Massachusetts	June 21, 1875	16	9	3	6	5	9	8	229	2	19	

CADET-MIDSHIPMEN, SECOND CLASS—RELATIVE STANDING. 17

		Alabama	Sept. 15, 1875	0	2	4	4	10	6	140	2	19
34	Road, John	Wisconsin	Sept. 24, 1874	15	6	12	6	16	7	24	2	19
31	Jungens, Charles William	Connecticut	June 21, 1875	17	10	35	28	22	38	25	152	2
32	Kellogg, Francis Woodruff	Tennessee	Sept. 23, 1874	17	6	30	30	34	26	45	138	2
31	Lopez, Robert Piles	Indiana	Sept. 14, 1875	17	1	13	10	2	12	8	166	2
27	Menefee, Daniel Preston	California	Sept. 23, 1874	16	6	32	19	21	20	21	165	2
2	Miner, Randolph Huntington	Ohio	June 19, 1875	17	7	4	3	1	1	27	79	2
6	Moore, John McConnell	Indiana	June 21, 1875	15	6	7	5	3	8	33	199	2
35	Mudd, John Alexis	At large	Sept. 11, 1875	15	3	33	36	41	44	22	256	2
1	Foundstone, Homer Clarke	West Virginia	Sept. 24, 1874	14	0	.....	.....	.....	.....	.....	47	2
34	Read, Maurice Lance	South Carolina	Sept. 24, 1874	15	10	41	26	36	33	47	166	2
14	Ripley, Charles Stedman	At large	June 17, 1875	17	11	11	25	25	17	1	162	2
19	Robinson, Herbert Judson	New Hampshire	Sept. 15, 1875	16	6	28	27	15	21	5	130	2
21	Schwerin, Kennie Pierre	New York	Sept. 23, 1874	16	1	20	36	20	23	12	89	2
23	Sears, Walter Jesse	Pennsylvania	June 21, 1875	17	8	24	21	22	11	31	165	2
16	Sloan, Robert Sage	New York	June 21, 1875	15	7	7	9	7	36	25	226	2
29	Snowden, Thomas	New York	June 21, 1875	17	10	26	33	15	13	23	70	2
37	Sturdivant, Harry Leland	Maine	June 13, 1874	17	8	24	24	46	40	37	320	2
33	Thom, William Arthur	At large	June 21, 1875	17	8	37	38	26	16	35	112	2
30	Tillman, Edwin Hord	Tennessee	Sept. 14, 1875	16	10	23	21	43	46	31	216	2
42	Welsh, George Silvia	Pennsylvania	Sept. 24, 1874	17	7	39	41	44	44	35	210	2
8	Wike, Harvey	Illinois	Sept. 16, 1875	14	7	5	16	19	27	43	185	2

† Out of the service — months.

14 CADET-MIDSHIPMEN, FIRST CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN,
First class—36 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—									Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Naval tactics.	Ordnance instruction.	Infantry tactics.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Spanish.		Months.	Days.
28	Alay, Augustus Craven.....	At large.....	June 6, 1872.....	15	6	30	21	31	9	36	35	24	32	22	32	182	9	12
15	Atwater, Charles Nelson.....	New York.....	Sept. 24, 1873.....	16	3	13	11	20	25	22	15	21	3	10	17	82	7	26
14	Bibb, Peyton Benajah.....	Alabama.....	June 12, 1874.....	17	3	6	13	7	4	16	32	15	17	13	15	57	5	18
19	Biddle, Spencer Fullerton Baird...	At large.....	June 13, 1874.....	15	5	12	34	15	26	18	17	20	20	27	27	195	5	18
22	Canfield, William Chase.....	At large.....	Sept. 23, 1873.....	16	1	17	29	29	37	32	32	24	22	11	14	91	7	26
29	Clark, George Ramsey.....	Ohio.....	June 9, 1874.....	17	3	33	30	36	30	29	35	28	11	27	22	161	5	18
23	Craven, John Eccleston.....	At large.....	Sept. 24, 1874.....	15	10	29	14	20	28	28	20	18	35	32	28	182	5	18
35	Dent, Balne Caruthers.....	At large.....	June 5, 1873.....	16	7	27	35	35	31	35	30	28	33	34	37	191	7	27
41	Fillmore, John Hudson.....	Illinois.....	Sept. 24, 1874.....	17	10	1	1	2	2	1	1	1	15	14	6	104	5	18
5	Glennon, James Henry.....	California.....	Sept. 24, 1874.....	17	7	11	15	18	15	7	5	5	17	3	8	107	5	18
34	Hetherington, James Henry.....	Iowa.....	Sept. 9, 1874.....	17	7	22	28	23	31	34	35	31	13	37	36	163	5	18
13	Holcombe, John Hite Leo.....	Georgia.....	June 27, 1874.....	17	9	9	17	3	19	21	10	18	17	6	19	65	5	18
37	Hooker, Horatio Hill.....	Illinois.....	Sept. 26, 1874.....	17	0	37	37	34	23	25	31	24	36	34	34	190	5	18
17	Hughes, Richard Morris.....	Pennsylvania.....	Sept. 25, 1874.....	15	8	26	23	19	28	14	17	14	19	5	3	143	5	18
12	Huse, Harry McLaren Pinkney.....	New York.....	Sept. 30, 1874.....	15	10	15	10	14	17	24	7	16	1	1	2	134	5	18
31	Kinnell, Harry.....	Pennsylvania.....	Sept. 28, 1874.....	14	5	36	16	27	22	17	12	11	22	19	10	144	5	18
8	Knapp, Harry Shepard.....	Connecticut.....	June 26, 1874.....	18	0	9	23	11	14	10	14	9	5	4	9	147	5	18
36	Knapp, John Joseph.....	Missouri.....	June 9, 1874.....	16	8	35	32	31	33	30	27	28	29	36	25	113	5	18
16	Lloyd, Edward, Jr.....	Maryland.....	June 17, 1874.....	16	11	18	6	12	6	12	25	17	24	7	15	53	5	18
43	McClain, Charles Sumner.....	Indiana.....	Nov. 2, 1874.....	17	2	3	3	1	3	4	6	4	10	11	4	107	5	18
20	McDonnell, John Edmund.....	Nevada.....	Sept. 20, 1874.....	16	4	25	31	13	21	27	23	31	20	23	7	54	5	18
7	O'nealy, George Francis.....	Ohio.....	Sept. 24, 1873.....	17	4	14	27	6	24	13	9	7	4	7	6	57	5	26

CADET-MIDSHIPMEN, THIRD CLASS—RELATIVE STANDING. 19

18	At large	Sept. 11, 1876	15	6	96	19	0	49	233	18
18	South Carolina	June 19, 1875	10	1	7	19	19	4	104	18
18	Ohio	June 21, 1875	16	5	13	42	15	37	201	18
5	At large	June 21, 1875	17	11						5
29	Gray, James	Sept. 12, 1876	17	8	34	29	23	31	221	2
37	Gresham, William Albert	June 19, 1875	17	3	58	64	61	14	86	0
55	Haecker, Francis Joy	Sept. 12, 1876	16	5	54	63	57	10	251	2
21	Marion, George Edward	June 19, 1875	17	11						2
52	Haskell, Porter David	Sept. 12, 1876	17	4	36	14	10	55	46	2
7	Hill, Charles Homer	Sept. 14, 1875	16	0	30	47	65	70	709	0
15	Honrigan, Patrick William	June 21, 1876	16	7	8	2	35	36	257	2
35	Howze, Arthur Robertson	June 21, 1876	15	7	11	45	17	43	97	2
5	Huntton, Fitz-Aubert	Sept. 15, 1875	16	10	23	37	48	37	344	2
55	King, William Nephew, Jr.	June 21, 1875	17	5						0
10	Lerisce, Leonidas	June 21, 1875	17	6	55	60	48	39	107	2
16	Lieber, Edwards Faysoux	June 21, 1875	16	7	18	15	16	21	19	2
5	Luby, John Fraser	June 21, 1875	17	11						2
16	Maxwell, William John	June 9, 1874	15	2						2
14	Mayer, Augustus Newkirk	June 12, 1876	17	3	17	92	46	41	140	2
22	Morgan, Stokely	June 14, 1876	16	11	14	17	59	23	56	2
11	Muir, William Carpenter Penulaton	June 21, 1876	17	3	30	26	7	28	180	2
64	Nash, Edwin White	Sept. 12, 1876	16	5	19	7	13	33	204	2
36	Niblack, Albert Parker	Sept. 11, 1876	16	11	60	49	76	58	258	2
5	Norton, Luman Spooner	Sept. 12, 1876	17	2	49	10	32	42	199	2
17	Parke, Thomas Aloysius	Sept. 12, 1876	17	0	4	8	31	15	304	2
31	Perkins, Con Marnet	June 21, 1876	16	8	22	16	4	64	162	2
16	Perry, George Ernest	Sept. 11, 1875	14	11	39	25	46	12	154	2
27	Phelps, Harry	Sept. 12, 1876	15	7	10	52	27	53	255	2
58	Richardson, Walter Gates	Sept. 12, 1876	16	9	70	29	71	51	134	2
47	Rodman, Hugh	Sept. 12, 1875	16	8	46	42	58	28	247	2
61	Rothacker, Joseph Hamilton	June 21, 1876	17	9	26	13	98	62	98	2
26	Safford, William Edwin	Sept. 11, 1876	16	9	42	22	13	13	86	2
5	St. George Andrew	June 21, 1875	17	0						2

20 CADET-MIDSHIPMEN, THIRD CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN.

Third class—71 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.			Months.	Days.
39	Scott, Richard Hamilton	Minnesota	June 21, 1876	17	9	28	39	77	43	115		18	18
62	Sims, William Sowden	Pennsylvania	June 21, 1876	17	8	69	64	70	6	196		18	18
25	Simpson, Edward, Jr.	At large	June 21, 1876	15	9	30	30	26	48	59		18	18
5	Swift, Franklin	Massachusetts	June 9, 1874	16	1							19	19
12	Truxton, William	At large	June 21, 1876	15	3	15	19	43	7	120		18	18
50	Van Duzer, Louis Sayre	New York	Sept. 13, 1876	15	3	63	40	66	24	78		18	18
67	Vance, Zebulon Baird	North Carolina	June 22, 1876	16	0	63	57	71	58	280		18	18
34	Wall, Francis Richardson	Mississippi	June 23, 1876	16	11	30	22	39	73	121		18	18
33	Walters, John Sproston	Connecticut	June 21, 1876	14	11	21	51	29	26	168		19	19
1	Webster, Edwin Belden	New York	Sept. 22, 1874	16	6							18	18
16	West, George Ernest	Louisiana	Sept. 12, 1876	14	5	11	37	37	46	107		19	19
7	Wilkinson, Ernest	Illinois	June 19, 1875	17	2							18	18
24	Wolfersberger, William Henry	Alabama	Sept. 12, 1876	17	7	5	5	33	26	75		18	18
61	Worthington, Thomas	Alabama	June 19, 1876	16	7	53	62	78	51	179		18	18

‡ Turned back from the second class.

† Out of the service — months.

‡ Suspended for one academic year by order of the Navy Department.

CADET-MIDSHIPMEN, FOURTH CLASS.

21

CADET-MIDSHIPMEN.

Fourth class—120 members.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
rs, Horace Burlingame	Michigan	June 22, 1876	15	1
John Thompson	Wyoming Terr	Sept. 27, 1877	17	10
k, William Frederick	Louisiana	Sept. 19, 1876	15	8
ine, Henry Laird	Tennessee	June 20, 1877	16	6
t, George	Wisconsin	June 19, 1877	17	6
erett Nelson	Tennessee	Aug. 23, 1877	17	11
er, Oscar Heary	Oregon	June 21, 1876	16	6
t, Louis Slocum	New Jersey	Sept. 11, 1877	15	9
esley Erastus	Illinois	Sept. 11, 1876	17	1
Robert Bunch	North Carolina	Sept. 11, 1877	16	7
George Preston	Virginia	June 21, 1876	15	11
Samuel	Maryland	June 14, 1876	17	3
Juy Morville	Maine	Sept. 11, 1877	16	10
Frank Emory	Ohio	June 20, 1877	16	1
rt, Edward Everett	Ohio	June 22, 1877	17	11
Eugene	At large	June 19, 1877	16	2
George	Illinois	June 22, 1877	14	11
Abbott Stanislaus	Illinois	June 26, 1877	17	11
Rudolphus Rouse	Illinois	June 21, 1875	17	8
Harry Radcliffe	At large	June 20, 1877	15	4
t, James Hane	At large	June 20, 1877	16	10
y, John Joseph	New York	Sept. 11, 1877	17	10
Macdonough	New York	June 21, 1876	17	7
Ben Holliday	Missouri	June 14, 1876	16	8
aw, James Davis	Texas	Sept. 11, 1877	17	10
ll, Robert Brooke	At large	June 19, 1877	16	11
dwin Peter	Missouri	June 14, 1876	17	2
idney Hope	At large	Sept. 11, 1876	15	7
ly, Michael Joseph	Wisconsin	June 21, 1877	17	7
Charles Augustus	New Hampshire	June 21, 1876	16	9
James Gregory	Pennsylvania	June 21, 1877	17	1
r, James Walter	Minnesota	June 21, 1877	16	8
, Charles Jackson	Georgia	Sept. 11, 1877	17	0
ge, Houston	At large	Oct. 2, 1876	15	7
tt, William LeRoy	At large	June 26, 1876	16	11
e Yonoske	Empire of Japan	Sept. 18, 1877	19	.....
er, William Bartlett	Vermont	Sept. 11, 1877	15	8
oy, William Francis	Louisiana	June 19, 1877	17	9
William Griffing	Arkansas	Sept. 11, 1877	15	7
t, Rutherford Worster	New York	Sept. 12, 1877	16	2
w, Robert Pierpont	New York	June 21, 1876	16	11
Edward West	Tennessee	June 21, 1876	16	1
in, Thomas Baber	Tennessee	Sept. 15, 1875	17	11
d, John Spotswood	At large	June 21, 1876	17	4
, Charles Peaslee	Illinois	July 1, 1876	16	3
k, William Jacob	Pennsylvania	Sept. 11, 1877	15	5
Revere Randolph	District of Columbia	Sept. 11, 1877	16	1
Henry Cargill	At large	June 26, 1875	15	7
Robert Peter	Maine	Sept. 12, 1876	16	3

CADET-MIDSHIPMEN.

Fourth class—120 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
Harman, Eugene Marion	Ohio	June 20, 1877	17	10
Hayden, Thomas Warren	Massachusetts	Sept. 11, 1877	16	8
Harrison, Edward Hanson	At large	June 21, 1877	13	18
Hoogewerff, John Adrian	At large	June 21, 1877	18	7
Hoke, William Peyton	Kentucky	Sept. 11, 1877	16	4
Howard, William Lauriston	Connecticut	Sept. 11, 1877	17	6
Hubbard, Nathaniel Mead	At large	Sept. 11, 1877	17	8
Hunnicke, Felix Harman	Missouri	Sept. 11, 1877	17	6
Jackson, Malcolm	Indiana	Sept. 11, 1877	17	3
Jones, Alexander James	Illinois	Sept. 11, 1877	17	2
Karmany, Lincoln	Pennsylvania	Sept. 12, 1877	17	8
Kase, Spencer Mettler	Illinois	Sept. 11, 1877	17	10
Kent, George Edward	New York	June 21, 1877	16	10
Kennett, Percy	Montana Ter	Sept. 12, 1877	17	6
Key, Albert Lenoir	Tennessee	June 21, 1877	16	13
Kimball, John Arthur	Massachusetts	Sept. 12, 1877	17	8
Lankin, John Alens	Mississippi	June 21, 1877	17	2
Lauchelmer, Charles Henry	Maryland	Sept. 11, 1877	17	11
Lindsey, John Howard	Pennsylvania	June 21, 1876	16	2
Linnard, Joseph Hamilton	Pennsylvania	June 21, 1877	16	8
McCrea, Alexander Sterling	At large	Oct. 2, 1876	17	2
McGiffin, Philo Norton	Pennsylvania	Sept. 11, 1877	16	9
McJunkin, Ira	Pennsylvania	June 20, 1877	17	4
McKee, Llewelyn Thomas	Pennsylvania	June 20, 1877	17	8
McNair, Finley Alexander	Indiana	Sept. 11, 1877	16	9
McWhorter, Jacob Gray	Georgia	Sept. 12, 1877	16	2
Mahoney, James Edward	Massachusetts	Sept. 12, 1876	16	8
Mathews, Thomas Henry	Pennsylvania	Sept. 12, 1876	16	1
Miner, John Rice	Ohio	June 21, 1876	15	10
Morgan, Daniel	Kentucky	Sept. 11, 1877	17	10
Morris, Walter Ellis	Pennsylvania	June 20, 1877	16	6
Moses, Franklin James	South Carolina	Sept. 11, 1877	16	8
Morton, Oliver Dwight	Ohio	June 21, 1877	17	11
Oliphant, Alexander Coulter	New Jersey	Sept. 12, 1877	17	3
Orlapp, Max Anton	Arkansas	June 19, 1876	17	1
Paine, Walter Taylor	Ohio	Sept. 11, 1877	14	11
Parker, Felton	Iowa	Nov. 6, 1876	16	6
Parsons, Arthur Carlton	Iowa	June 21, 1876	17	11
Patterson, Samuel Achmuty Wainwright	At large	June 21, 1876	16	8
Phythian, Charles Taylor	Kentucky	June 19, 1877	16	8
Pierre, Byron Gilmore	Illinois	June 21, 1877	17	4
Plousants, Charles	Indiana	Sept. 11, 1877	17	11
Poyer, John Martin	At large	June 21, 1877	15	8
Printap, David Lawrence	New York	June 21, 1877	17	3
Rees, John Levermore	Michigan	June 21, 1877	17	4
Rider, Frederick Clinton	Rhode Island	Sept. 12, 1877	17	8
Robinson, William Moody	At large	June 23, 1876	17	4
Rodgers, Gay George	Tennessee	Sept. 23, 1876	14	1
Russell, William Worthington	At large	Sept. 12, 1876	17	8

CADET-ENGINEERS.

First class—14 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—							Number of demerits.		Sea-ser-vice in practice-ships.	
				Years.	Months.	Steam-engineering.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Spanish.			Months.	Days.
9	Bartlett, Frank William.....	Michigan.....	Oct. 1, 1874	18	1	7	11	6	12	8	6	8	163	4	4	27
8	Bieg, Frederick Charles.....	Missouri.....	Oct. 1, 1874	18	6	9	10	9	8	1	1	5	100	4	4	27
4	Bull, Gould Hoyt.....	Pennsylvania.....	Oct. 1, 1874	18	4	5	4	4	5	4	5	4	119	4	4	27
11	Burd, George Eli.....	Massachusetts.....	Oct. 1, 1874	17	5	10	12	7	9	8	9	11	108	4	4	27
7	Cooley, Mortimer Elwyn.....	New York.....	Oct. 1, 1874	19	6	4	4	5	7	7	13	11	104	4	4	27
12	Gage, Howard.....	Michigan.....	Oct. 1, 1874	18	1	14	6	10	10	13	10	10	140	4	4	27
13	Gow, John London.....	Indiana.....	Oct. 1, 1874	18	4	13	9	12	11	14	12	15	140	4	4	27
6	Griffin, Robert Stanislaus.....	Virginia.....	Oct. 1, 1874	17	6	8	6	8	6	8	4	1	78	4	4	27
41	Hollis, Ira Nelson.....	Kentucky.....	Oct. 1, 1874	18	6	1	2	2	2	6	3	2	100	4	4	27
5	McElroy, George Wightman.....	Michigan.....	Oct. 1, 1874	16	6	6	8	10	4	15	11	16	198	4	4	27
92	Schell, Franklin Jacob.....	Pennsylvania.....	Oct. 1, 1874	17	1	3	1	1	3	2	2	3	62	4	4	27
3	Spangler, Harry Wilson.....	Pennsylvania.....	Oct. 1, 1874	16	9	2	2	3	1	8	2	7	121	4	4	27
14	Wright, Charles Leslie.....	Massachusetts.....	Oct. 1, 1874	20	1	12	14	14	12	12	16	13	139	4	4	27
10	Wilmer, Joseph Bluggold.....	Maryland.....	Oct. 1, 1874	20	10	11	13	14	14	3	7	6	112	4	4	27

CADET-ENGINEERS.

Second class—24 members.

Order of annual review.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and composition.	French.	Drawing.	Months.		Days.	
9	Acker, Edward O'Connor...	Pa	Sept. 15, 1875	17	4	18	1	7	16	7	53	2	20	
10	Aunan, John Wesley	Mass ..	Sept. 15, 1875	19	...	13	11	6	10	13	213	2	20	
24	Baker, John Howard	R. I ...	Sept. 15, 1875	18	...	19	18	24	27	19	150	2	20	
11	Bennett, Frank Marion	Mich ..	Oct. 1, 1874	17	5	12	14	4	14	5	182	2	20	
16	Bevington, Martin	Ohio ..	Sept. 15, 1875	17	10	22	13	11	19	11	183	2	20	
22	Bowles, Francis Tiffany	Mass ..	Sept. 15, 1875	16	11	2	3	4	4	3	92	2	20	
17	Bowers, Frederic Clay	N. J. ...	Sept. 15, 1875	17	7	16	17	17	8	25	230	2	20	
5	Bryan, Benjamin Chambers	N. J. ..	Sept. 15, 1875	17	1	4	9	10	7	15	128	2	20	
4	Carr, Clarence Alfred	Pa	Sept. 15, 1875	19	1	6	6	3	6	21	112	2	20	
21	Carter, Thomas Frederic ...	Ky	Oct. 1, 1873	18	3	20	23	19	25	14	76	2	20	
12	Crygier, John Ulysses	N. Y. ..	Oct. 1, 1874	16	6	9	12	16	9	6	171	2	20	
12	Elsaffer, Harry Smith	Iowa ..	Oct. 1, 1874	19	3	17	16	19	13	8	174	2	20	
23	Gatewood, Richard	Va	Sept. 15, 1875	15	11	3	8	1	1	4	106	2	21	
8	Hunt, Andrew Murray	Ind ...	Sept. 15, 1875	16	2	8	7	9	5	17	155	2	20	
14	Isbester, Richard Thornton ..	Tenn ..	Sept. 15, 1875	18	3	14	10	13	22	17	198	2	20	
6	Ivers, Henry King	Mo	Oct. 1, 1874	18	6	...	...	...	...	...	...	4	27	
6	Lubbe, Charles Bethel	Pa	Sept. 15, 1875	18	3	5	4	15	19	15	156	2	20	
21	McFarland, Walter Martin	D. C. ...	Sept. 15, 1875	16	1	1	2	2	2	20	108	2	20	
7	Noell, Michael Daniel	Pa	Sept. 15, 1875	17	5	7	4	8	14	27	5	2	20	
13	Norton, Harold Percival ...	N. Y. ..	Oct. 1, 1874	18	10	9	14	14	21	2	85	2	20	
7	Pickrell, Joseph McCall	Va	Oct. 1, 1874	17	2	...	...	...	...	...	...	2	9	
20	Salisbury, George Robert ...	Mo	Oct. 1, 1874	19	7	21	20	25	12	9	85	2	20	
15	Scribner, Edward Herschell ..	Mass ..	Oct. 1, 1874	19	11	11	19	22	17	11	100	2	20	
19	Talcott, Charles Gratiot	Va	Sept. 15, 1875	16	...	14	21	21	15	10	157	2	20	

§ Turned back from the first class.

† Re-instated.

CADET-ENGINEERS.

Third class—21 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Sea service in practice ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.	Number of demerits.	Drs.	Months.	Days.
11	Aldersee, William Hillary.....	Penn.	Sept. 14, 1876	16	9	8	11	20	4	288	2	11	
19	Belden, Charles Emory.....	Ohio..	Sept. 14, 1876	16	6	16	22	23	18	92	2	11	
4	Durand, William Frederick.....	Conn.	Sept. 14, 1876	17	6	4	8	12	5	96	2	10	
18	Hall, Harry.....	Penn.	Sept. 14, 1876	17	9	20	16	25	18	78	2	11	
*1	Hasson, William Frederick												
	Converse.....	Ohio..	Sept. 14, 1876	19	4	1	2	1	8	99	2	11	
13	King, Charles Alfred.....	Md....	Sept. 14, 1876	18	1	13	7	18	16	149	2	11	
10	Kinkaid, Thomas Wright.....	Ohio..	Sept. 14, 1876	16	6	11	4	14	20	47	2	11	
15	Lang, William.....	N. Y..	Sept. 14, 1876	18	8	17	11	11	24	185	2	11	
23	Lillebridge, Frederick May.....	Conn.	Sept. 14, 1876	17	9	19	23	15	14	163	2	11	
12	Manning, Charles Edward.....	N. Y..	Sept. 14, 1876	17	6	12	13	8	12	76	2	11	
20	Mathews, Clarence Herbert.....	Ohio..	Sept. 14, 1876	19	7	18	21	22	10	227	2	11	
16	Miller, Clarence Alexander.....	Va....	Oct. 27, 1875	18	11	14	19	24	17	302	2	11	
3	Miner, Leo Dwight.....	Ohio..	Sept. 14, 1876	17	7	3	9	16	3	45	2	11	
5	Sample, Winfield Scott.....	Penn.	Sept. 14, 1876	18	10	5	15	21	7	74	2	11	
8	Smith, Albert Edward.....	Wis....	Sept. 14, 1876	17	8	9	6	19	9	115	2	11	
*2	Stahl, Albert William.....	N. Y..	Sept. 14, 1876	19	4	2	1	3	1	168	2	11	
17	Weaver, William Dixon.....	Penn.	Sept. 14, 1876	19	1	22	9	12	15	297	2	11	
6	Wood, Joseph Learned.....	Va....	Sept. 14, 1876	20	2	6	3	2	22	108	2	11	
7	Woods, Arthur Tannatt.....	Mass.	Sept. 14, 1876	17	7	7	20	5	2	52	2	11	
14	Worthington, John Leeds.....	Md....	Sept. 14, 1876	18	3	15	18	6	22	83	2	11	
9	Young, Albert Osborn.....	N. Y..	Sept. 14, 1876	19	2	9	14	10	13	122	2	11	

CADET-ENGINEERS.

Fourth class—30 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
Martin Augustus	Wisconsin	Sept. 13, 1877	19	11	14
on	Maryland	Sept. 14, 1876	22	2	23
loyd	Pennsylvania	Sept. 13, 1877	19	9	24
ert James	New York	Sept. 13, 1877	19	10	9
ar Richmond	Massachusetts	Sept. 13, 1877	17	4	10
es Edwin	Massachusetts	Sept. 14, 1876	19	5	19
Bunner	Ohio	Sept. 13, 1877	19	10	3
ok Botland	Massachusetts	Sept. 13, 1877	18	3	15
man	Ohio	Sept. 14, 1876	20	2	25
William Henry	Pennsylvania	Sept. 13, 1877	18	1	2
Daniel Demarest	New Jersey	Sept. 13, 1877	18	1	18
ig, Gustave	Indiana	Sept. 13, 1877	19	3	8
Andrew	New York	Sept. 13, 1877	19	3	21
Kennett	Virginia	Sept. 13, 1877	17	0	23
Harry Raynor	Maryland	Sept. 13, 1877	17	7	12
ert	New York	Sept. 13, 1877	17	2	6
thur	New York	Sept. 14, 1876	19	5	5
as Brown	Michigan	Sept. 13, 1877	17	8	7
man Barnham	Connecticut	Sept. 13, 1877	18	7	11
erbert Pranker	Massachusetts	Sept. 13, 1877	19	8	25
DeWitt Clinton	Maryland	Sept. 13, 1877	19	2	20
ias Clay	Illinois	Sept. 13, 1877	19	6	5
er, Oliver Blackburn	Pennsylvania	Sept. 13, 1877	17	4	1
iam Stuart	New York	Sept. 13, 1877	19	8	19
, Robert	Michigan	Sept. 13, 1877	19	5	22
thur Wallace	Massachusetts	Sept. 15, 1875	20	9	1
William Townsend	New York	Sept. 13, 1877	20	1	4
ham Wilmot	Pennsylvania	Sept. 13, 1877	17	11	16
ay Manuel	Illinois	Sept. 13, 1877	19	0	17
ewellyn Fairfax	Virginia	Sept. 13, 1877	18	9	13

SUMMARY.

October 1, 1877.

CADET-MIDSHIPMEN.

.....	30 members.
.....	44 members.
.....	71 members.
.....	120 members.

271

CADET-ENGINEERS.

.....	14 members.
.....	24 members.
.....	21 members.
.....	30 members.

89

360

from the Empire of Japan are received for instruction under a resolution of the Senate and representatives of the United States, approved July 27, 1863.

ANNUAL RIFLE-MATCH

BETWEEN MEMBERS OF THE GRADUATING CLASS, JUNE 10-20, 1877.



Target showing score of H. M. Witzel.

TERMS OF THE MATCH.

Target, that adopted by the National Rifle
Association of 1875.
Distance, 400 yards.
Rifle, Remington Navy.

Position, that of a skirmisher lying down
Number of shots, 7.
Possible score, 35.

Name.	1.	2.	3.	4.	5.	6.	7.	Total.	Referred to target
H. M. Witzel	5	5	4	5	5	5	5	34	
W. G. David	5	5	5	5	5	3	5	33	
P. I. Werlich	4	5	4	5	5	5	5	33	
A. W. Dodd	5	3	5	5	5	5	4	32	
W. L. Burdick	3	3	5	5	5	5	5	31	
Total								163	1

Class score.

Number of points made by class, 45 members	7
Average score	66
Number of points referred to target in use in 1876	60
Average score referred to target in use in 1876	14

SUMMER-CRUISE, 1877.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION.

Commander EDWARD TERRY, *Commanding*.
Lieutenant-Commander C. V. GRIDLEY, *Executive Officer*.
Lieutenant-Commander C. W. KENNEDY, *Navigator*.
Lieutenant S. HUBBARD, *Senior Watch-Officer*.
Lieutenant C. C. CORNWELL, *Watch-Officer*.
Lieutenant J. F. MEIGS, *Watch-Officer*.
Lieutenant C. G. BOWMAN, *Watch-Officer*.
Lieutenant A. P. NAZRO, *Watch-Officer*.
Master W. P. CLASON, *Watch-Officer*.
Ensign T. B. HOWARD, *Watch-Officer*.
Ensign A. A. MICHELSON, *Watch-Officer*.
Surgeon, W. J. SIMON.
Assistant Surgeon, GEORGE ARTHUR.
Paymaster, A. S. KENNY.
Chaplain, ROBERT HUDSON.
Boatswain, A. MILNE.
Gunner, ROBERT SOMMERS.
Clerk to Commandant of Cadets, C. M. McLEOD.
Paymaster's Clerk, JAMES MCGREGOR.

CADET-MIDSHIPMEN.

First class (36).

A. C. Almy.	J. H. Glennon.	E. Lloyd, jr.	J. H. Shipley.
C. N. Atwater.	J. H. Hetherington.	C. S. McClain.	R. C. Smith.
P. B. Bibb.	J. H. L. Holcombe.	J. E. McDonnell.	G. Sparhawk.
S. F. B. Biddle.	H. H. Hooke.	G. P. Ormsby.	F. J. Sprague.
W. C. Canfield.	R. M. Hughes.	J. G. Quinby.	G. H. Stafford.
G. R. Clark.	H. M. P. Huse.	T. S. Rodgers.	W. L. Todd.
J. E. Craven.	H. Kimmell.	W. L. Rodgers.	W. P. White.
B. C. Dent.	H. S. Knapp.	A. G. Rogers.	A. N. Wood.
J. H. Fillmore.	J. J. Knapp.	T. W. Ryan.	R. K. Wright.

J. L. Purcell.

Third class (61).

A. Ackerman.	J. B. Bernadon.	E. D. Bronner.	C. Cabanis.
F. R. Alger.	F. W. Bowdon.	J. S. Brown.	L. J. Clark.
H. B. Ashmore.	F. R. Brainard.	Samuel Bryan.	P. B. Cooke.
J. B. Bailey.	E. Brinley.	H. H. Bullitt.	T. G. Dewey.

Third class—Continued.

J. M. Dickson.	H. C. Haines.	A. P. Niblack.	F. Swift.
G. L. Dillman.	P. D. Haskell.	L. S. Norton.	W. Truxton.
J. C. Drake.	P. W. Hourigan.	T. A. Parke.	L. S. Van Duzer.
H. G. Dresel.	A. R. Howze.	C. M. Perkins.	Z. B. Vance.
L. Duncan.	F. A. Hantoon.	H. Phelps.	F. R. Wall.
W. H. Emerson.	E. F. Lieper.	W. G. Richardson.	J. S. Watters.
M. K. Eyre.	L. Levissee.	H. Rodman.	G. E. West.
H. L. Fillebrown.	A. N. Mayer.	J. H. Rohrbacher.	W. H. Wolfersberger.
H. M. Finley.	S. Morgan.	W. E. Safford.	T. Worthington.
G. R. French.	W. C. P. Muir.	R. H. Scott.	W. N. King.
James Gray.	J. B. Murray.	W. S. Sims.	J. F. Luby.
F. J. Haeseler.	E. W. Nash.	E. Simpson.	E. B. Webster.

The Constellation sailed from Annapolis Roads, June 26, for Buzzard's Bay, touched at New Bedford, Mass.; from thence to the navy-yard, New York; returning, touched at Newport, R. I., and Norfolk, Va., and arrived at the Naval Academy September 13, 1877.

UNITED STATES PRACTICE-SHIP MAYFLOWER.

Commander W. T. SAMPSON, *Commanding.*

Lieutenant D. KENNEDY.

Lieutenant T. B. MASON.

Passed Assistant Engineer L. W. ROBINSON.

Passed Assistant Engineer C. W. RAE.

Assistant Surgeon A. A. AUSTIN.

CADET-ENGINEERS.

First class (14).

F. W. Bartlett.	M. E. Cooley.	J. N. Hollis.	H. W. Spangler.
F. C. Beig.	H. Gage.	H. K. Ivers.	C. L. Wight.
G. H. Bull.	J. L. Gow.	G. W. McElroy.	J. R. Wilmer.
G. E. Burd.	R. S. Griffin.	F. J. Schell.	

Third class.

W. H. Allderdice.	T. W. Kinkaid.	L. D. Miner.	J. L. Wood.
C. E. Belden.	W. Lang.	A. Nichols.	A. T. Woods.
W. F. Durand.	F. M. Lillibridge.	W. S. Sample.	J. L. Worthington.
H. Hall.	C. E. Manning.	A. E. Smith.	A. O. Young.
W. F. C. Hasson.	C. H. Mathews.	A. W. Stahl.	
C. A. King.	C. A. Miller.	W. D. Weaver.	

The Mayflower left her anchorage June 26, and accompanied the Constellation to sea, proceeded thence to Wilmington, Del., Chester and Philadelphia, Pa., navy-yard Brooklyn, Cold Springs, Newburgh, and West Point, N. Y.; returning touched at Newport torpedo station and Providence, R. I., sailed thence for the Chesapeake, touched at Norfolk, and arrived at the Naval Academy September 13, 1877.

coefficients to be applied to the final averages in each branch in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Coefficients.				Graduating maximum for required studies.
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Ship	Seamanship.....			12	12	136
	Naval Construction.....				8	
	Naval Tactics.....			2		
	Ordnance Instructions.....			3		
and Gunnery	Infantry Tactics.....			2		76
	Ordnance and Armor.....				14	
Mathematics	Algebra and Geometry.....	9				108
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		18			
Engineering	Marine Engines.....				12	48
Survey, Navigation, and Hydrography	General Astronomy.....			6		84
	Navigation and Surveying.....				16	
Physics and Chemistry	Physics and Chemistry.....		8			88
	Electricity.....			6		
	Light and Heat.....				8	
Physics and Applied Mathematics	Mechanics and Applied Mathematics.....			14		56
Literary Studies, History, and Civics	English and History.....	6				80
	History and Rhetoric.....		6			
Languages	Composition.....			5		64
	Public Law.....				3	
	French.....	2	4	4		64
	Spanish.....			3	3	
	Line-drawing and Topography.....	2				16
	Sketching.....		2			
Sum for each year		76	152	228	304	760
Sum for each demerit		.004	.007	.013	.02	

Table of coefficients to be applied to the final averages in each branch, &c.—Continued

CADET-ENGINEERS.

Department.	Subject.	Coefficients.			
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.
Seamanship.....	Naval Construction				8
Mathematics.....	Algebra and Geometry	9			
	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		13		
Steam-Engineering	Mechanical Drawing	2	2		
	Fabrication of Machinery.....				
	Designing of Machinery			19	20
Astronomy, Navigation, and Surveying	Marine Engines				
	General Astronomy.....			6	
Physics and Chemistry ...	Physics and Chemistry		8		
	Electricity.....			6	
	Light and Heat				8
Mechanics and Applied Mathematics.....	Physical Measurements.....				7
	Mechanics and Applied Mathematics ..			14	
English Studies, History, and Law	Mechanics				11
	English and History	6			
	History and Rhetoric		6		
Modern Languages	Composition			5	
	Public Law				3
.....	French.....	2	4	4	
	Spanish			3	3
Maximum for each year.....		76	132	228	364
Deduction for each demerit ..		.004	.007	.01	.03

Cadet-Midshipman F. L. Berkeley	Sept. 28, 1877
Cadet-Midshipman Washington Irving	Sept. 28, 1877
Cadet-Midshipman J. P. Porter	Sept. 28, 1877
Cadet-Midshipman J. T. Wallace	Sept. 28, 1877
Cadet-Midshipman B. H. Williamson	Sept. 28, 1877
Cadet-Midshipman M. M. Reamer	Sept. 28, 1877
Cadet-Midshipman John Taylor	Sept. 28, 1877
Cadet-Engineer F. L. Bartholow	Sept. 28, 1877
Cadet-Engineer T. J. Hogan	Sept. 28, 1877
Cadet-Engineer W. S. Smith	Sept. 23, 1877

† Re-instated and since deceased.

ACCEPTANCE OF RESIGNATION REVOKED.

Cadet Midshipman Leonidas Levisse	Dec. 14, 1876
---	---------------

CADET-MIDSHIPMEN.

Merit-roll of first class (45 members), annual examination, June, 1877, and general merit-roll for four years.

Order of general merit.	Name.	Sennanship.	Naval construction.	Ordnance.	Marine-engineer.	Navigation.	Light and heat.	Law.	Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
		48	32	56	48	64	32	12	12		304	228	152	67.91	751.91
1	William F. Fullam.....	40.80	59.20	51.52	39.84	55.36	50.56	10.17	9.36	5.31	264.20	198.65	135.57	61.53	600.18
2	Horace M. Witzel.....	39.96	59.36	50.51	45.72	54.88	51.26	9.54	9.24	3.33	298.91	192.93	132.43	61.26	655.53
3	Onesimo G. Dodge.....	41.52	56.32	47.71	39.12	56.00	50.92	9.96	9.46	4.66	255.78	185.14	128.43	56.30	623.54
4	William G. David.....	39.84	56.96	49.84	37.32	53.92	49.84	10.32	9.57	3.50	274.31	184.55	129.47	56.31	623.66
5	Albert G. Winterhalter.....	36.60	56.80	43.18	34.32	56.16	45.84	10.62	11.10	2.34	242.86	184.25	134.11	60.61	621.93
6	Alfred Jeffries.....	41.40	56.64	50.54	36.00	55.00	45.76	9.94	10.32	0.69	270.91	180.70	129.59	54.48	621.68
7	John M. Orchard.....	33.96	55.64	46.90	37.80	53.60	50.48	9.97	9.94	4.95	246.71	186.40	128.63	57.84	610.61
8	William V. Brounagh.....	36.60	54.56	44.40	36.60	53.76	47.52	9.69	10.95	3.9	270.89	178.13	128.61	59.53	606.17
9	Russel G. Paris.....	32.76	55.92	43.12	36.60	57.92	47.04	9.97	10.98	4.14	269.77	193.22	131.75	59.40	603.14
10	John N. Jordan.....	38.52	54.32	43.62	37.32	53.00	49.64	9.54	9.97	3.13	292.50	194.86	129.95	52.71	602.35
11	Augustus F. Fechteler.....	34.56	55.36	47.60	34.32	52.32	47.76	9.72	9.33	3.91	245.92	176.60	129.60	56.77	590.65
12	Thomas M. Brumby.....	37.08	54.96	47.60	37.92	48.80	47.40	9.96	9.48	3.13	271.98	172.14	125.55	60.95	599.76
13	Jonathan K. Higgs.....	35.28	52.80	45.22	40.32	52.96	47.40	9.18	9.43	2.41	241.98	172.77	119.28	52.69	579.21
14	Edward E. Wright.....	32.80	52.80	45.22	41.32	52.96	47.40	9.18	9.23	4.34	241.52	173.04	117.64	52.01	565.03
15	Frank M. Boatwick.....	33.60	51.60	44.52	34.32	48.32	47.52	9.20	8.94	3.51	249.07	167.69	120.89	55.92	566.49
16	Sellin E. Woodworth.....	36.12	53.12	50.52	34.44	45.44	47.52	9.57	10.02	2.67	231.20	163.27	110.87	54.46	562.50
17	Albert Gleaves.....	36.36	52.64	45.22	35.64	45.84	45.16	9.69	8.79	2.58	232.41	161.23	115.87	54.41	559.92
18	Walter M. Constant.....	35.24	52.64	43.26	35.64	45.84	45.84	9.27	8.76	3.34	225.15	164.30	115.39	51.30	550.21
19	Vaughan E. Nelson.....	37.92	52.64	45.22	33.84	44.80	44.64	9.24	9.34	3.21	254.16	162.39	113.10	50.68	550.68
20	James W. Oliver.....	34.72	50.64	40.40	35.96	46.56	44.32	9.24	10.23	3.18	213.79	163.80	117.06	59.71	554.06
21	Arthur W. Bold.....	34.44	52.12	40.40	35.96	46.56	44.32	9.24	9.97	1.89	223.20	156.54	115.33	54.73	552.99
22	James P. Shaw.....	31.56	54.00	42.40	33.28	51.56	41.44	9.57	8.46	3.60	219.91	164.96	121.56	46.03	552.48
23	James P. Parker.....	34.32	52.88	40.02	31.60	46.72	41.36	10.11	8.70	4.34	215.78	166.41	115.44	53.29	551.22
24	Ben W. Hodgson.....	30.40	49.40	42.96	34.44	45.48	42.88	10.02	9.96	3.19	219.58	159.86	114.93	54.72	549.11
25	Albert W. Girard.....	34.44	49.40	42.96	34.44	45.48	42.88	10.02	9.96	3.19	219.58	159.86	114.93	54.72	549.11

SUMMER-CRUISE, 1877.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION.

Commander EDWARD TERRY, *Commanding.*
Lieutenant-Commander C. V. GRIDLEY, *Executive Officer.*
Lieutenant-Commander C. W. KENNEDY, *Navigator.*
Lieutenant S. HUBBARD, *Senior Watch-Officer.*
Lieutenant C. C. CORNWELL, *Watch-Officer.*
Lieutenant J. F. MEIGS, *Watch-Officer.*
Lieutenant C. G. BOWMAN, *Watch-Officer.*
Lieutenant A. P. NAZRO, *Watch-Officer.*
Master W. P. CLASON, *Watch-Officer.*
Ensign T. B. HOWARD, *Watch-Officer.*
Ensign A. A. MICHELSON, *Watch-Officer.*
Surgeon, W. J. SIMON.
Assistant Surgeon, GEORGE ARTHUR.
Paymaster, A. S. KENNY.
Chaplain, ROBERT HUDSON.
Boatswain, A. MILNE.
Gunner, ROBERT SOMMERS.
Clerk to Commandant of Cadets, C. M. McLEOD.
Paymaster's Clerk, JAMES MCGREGOR.

CADET-MIDSHIPMEN.

First class (36).

A. C. Almy.	J. H. Glennon.	E. Lloyd, jr.	J. H. Shipley.
C. N. Atwater.	J. H. Hetherington.	C. S. McClain.	R. C. Smith.
P. B. Bibb.	J. H. L. Holcombe.	J. E. McDonnell.	G. Sparhawk.
S. F. B. Biddle.	H. H. Hooke.	G. P. Ormsby.	F. J. Sprague.
W. C. Caulfield.	R. M. Hughes.	J. G. Quinby.	G. H. Stafford.
G. R. Clark.	H. M. P. Huse.	T. S. Rodgers.	W. L. Todd.
J. E. Craven.	H. Kimmell.	W. L. Rodgers.	W. P. White.
B. C. Dent.	H. S. Knapp.	A. G. Rogers.	A. N. Wood.
J. H. Fillmore.	J. J. Knapp.	T. W. Ryan.	R. K. Wright.

J. L. Purcell.

Third class (61).

A. Ackerman.	J. B. Bernadou.	E. D. Bronner.	C. Cabanis.
P. R. Alger.	F. W. Bowdon.	J. S. Brown.	L. J. Clark.
H. B. Ashmore.	F. R. Brainard.	Samuel Bryan.	P. B. Cooke.
J. B. Bailey.	E. Brituley.	H. H. Bullitt.	T. G. Dewey.

Third class—Continued.

J. M. Dickson.	H. C. Haines.	A. P. Niblack.	F. Swift.
G. L. Dillman.	P. D. Haskell.	L. S. Norton.	W. Truxton.
J. C. Drake.	P. W. Hourigan.	T. A. Parke.	L. S. Van Duzer.
H. G. Dresel.	A. R. Howze.	C. M. Perkins.	Z. B. Vance.
L. Duncan.	F. A. Hantoon.	H. Phelps.	F. R. Wall.
W. H. Emerson.	E. F. Lieper.	W. G. Richardson.	J. S. Watters.
M. K. Eyre.	L. Levisee.	H. Rodman.	G. E. West.
H. L. Fillebrown.	A. N. Mayer.	J. H. Rohrbacher.	W. H. Wolfersberger.
H. M. Finley.	S. Morgan.	W. E. Safford.	T. Worthington.
G. R. French.	W. C. P. Muir.	R. H. Scott.	W. N. King.
James Gray.	J. B. Murray.	W. S. Sims.	J. F. Luby.
F. J. Haeseler.	E. W. Nash.	E. Simpson.	E. B. Webster.

The Constellation sailed from Annapolis Roads, June 26, for Buzzard's Bay, touched at New Bedford, Mass.; from thence to the navy-yard, New York; returning, touched at Newport, R. I., and Norfolk, Va., and arrived at the Naval Academy September 13, 1877.

UNITED STATES PRACTICE-SHIP MAYFLOWER.

Commander W. T. SAMPSON, *Commanding.*

Lieutenant D. KENNEDY.

Lieutenant T. B. M. MASON.

Passed Assistant Engineer L. W. ROBINSON.

Passed Assistant Engineer C. W. RAE.

Assistant Surgeon A. A. AUSTIN.

CADET-ENGINEERS.

First class (14).

F. W. Bartlett.	M. E. Cooley.	J. N. Hollis.	H. W. Spangler.
F. C. Beig.	H. Gage.	H. K. Ivers.	C. L. Wight.
G. H. Bull.	J. L. Gow.	G. W. McElroy.	J. R. Wilmer.
G. E. Burd.	R. S. Griffin.	F. J. Schell.	

Third class.

W. H. Allderdice.	T. W. Kinkaid.	L. D. Miner.	J. L. Wood.
C. E. Belden.	W. Lang.	A. Nichols.	A. T. Woods.
W. F. Durand.	F. M. Lillebridge.	W. S. Sample.	J. L. Worthington.
H. Hall.	C. E. Manning.	A. E. Smith.	A. O. Young.
W. F. C. Hasson.	C. H. Mathews.	A. W. Stahl.	
C. A. King.	C. A. Miller.	W. D. Weaver.	

The Mayflower left her anchorage June 26, and accompanied the Constellation to sea; proceeded thence to Wilmington, Del., Chester and Philadelphia, Pa., navy-yard, Brooklyn, Cold Springs, Newburgh, and West Point, N. Y.; returning touched at Newport torpedo station and Providence, R. I., sailed thence for the Chesapeake, touched at Norfolk, and arrived at the Naval Academy September 12, 1877.

Table of coefficients to be applied to the final averages in each branch in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Coefficients.				Graduating maximum for required studies.
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship	Seamanship			12	12	136
	Naval Construction				8	
Ordnance and Gunnery	Naval Tactics			2		76
	Ordnance Instructions			3		
	Infantry Tactics			2		
Mathematics	Ordnance and Armor				14	108
	Algebra and Geometry	9				
Steam-Engineering	Trigonometry, Analytical Geometry, and Descriptive Geometry		18			48
	Marine Engines				12	
Astronomy, Navigation, and Surveying	General Astronomy			6		28
	Navigation and Surveying				16	
Physics and Chemistry	Physics and Chemistry		8			88
	Electricity			6		
Mechanics and Applied Mathematics	Light and Heat				8	56
	Mechanics and Applied Mathematics			14		
English Studies, History, and Law	English and History	6				80
	History and Rhetoric		6			
	Composition			5		
Modern Languages	Public Law				3	64
	French	2	4	4		
Drawing	Spanish			3	3	16
	Line-drawing and Topography	2				
	Sketching		2			
Maximum for each year		76	152	228	304	760
Deduction for each demerit		.004	.007	.013	.03	

CADET-MIDSHIPMEN.

Merit-roll of third class (50 members), annual examination, June, 1877.

Order of annual merit.	Name.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.	Conduct.
	Maxima	74	34	24	16	8	
1	A. B. Clements	72.54	29.60	20.16	11.44	6.60	0.94
2	R. H. Miner	68.40	28.64	21.60	14.44	5.50	0.55
3	E. E. Hayden	69.12	27.20	20.52	14.12	7.44	0.92
4	John Hood	69.84	28.48	20.58	12.43	6.90	0.89
5	H. S. Chase	61.20	29.68	18.18	13.08	6.86	1.68
6	J. M. Moore	57.60	27.92	20.64	12.72	5.40	1.29
7	L. M. Garrett	57.60	23.92	18.96	13.20	7.48	0.60
8	Harvey Wike	63.54	23.36	17.04	11.00	5.20	1.29
9	C. C. Marsh	54.90	25.44	20.70	12.94	6.68	1.16
10	R. S. Sloan	57.60	25.60	19.62	10.72	5.58	1.58
11	C. W. Jungen	55.26	25.76	17.58	13.00	5.66	1.58
12	Prentice Bailey	57.06	23.36	17.10	11.68	5.48	1.20
13	W. A. Gill	53.28	26.88	17.22	11.20	5.46	1.20
14	C. S. Ripley	55.98	22.08	16.44	11.76	7.46	1.13
15	J. B. Bish	54.36	24.40	16.26	12.64	5.16	0.82
16	J. B. Cahoon	54.90	22.48	17.94	10.96	6.08	0.96
17	C. H. Harlow	51.48	24.48	18.24	12.08	5.24	1.16
18	John Gibson	54.18	23.76	15.00	10.80	6.00	0.60
19	H. J. Robinson	48.78	21.92	17.76	11.32	7.04	0.44
20	Thomas Snowden	49.32	21.20	18.12	12.16	5.68	0.40
21	R. P. Schwerin	51.30	20.64	16.92	11.36	6.30	0.61
22	J. A. Dougherty	50.04	23.52	16.14	10.48	6.16	0.50
23	W. J. Sears	49.50	22.56	16.74	12.44	5.44	1.13
24	J. A. Bell	50.22	23.36	16.20	10.84	5.46	1.00
25	M. C. Gorgas	48.96	20.88	15.66	13.84	5.82	0.20
26	L. H. Barnard	47.88	21.76	18.12	11.96	5.24	0.55
27	D. P. Menefee	47.70	22.88	16.80	11.60	5.76	1.13
28	A. C. Cunningham	47.52	22.80	16.14	11.00	6.48	0.46
29	J. H. Gibbons	46.26	21.44	18.66	11.68	5.22	1.69
30	E. H. Tillman	49.68	22.56	15.12	10.08	5.44	1.51
31	R. F. Lopez	47.88	21.52	15.96	11.16	5.18	0.97
32	F. W. Kellogg	46.80	21.76	16.74	10.52	5.58	1.06
33	W. A. Thom	46.26	20.56	16.26	11.84	5.36	0.78
34	M. L. Read	45.36	22.00	15.78	10.70	5.12	1.06
35	J. A. Mudd	47.52	20.64	15.30	10.12	5.74	1.79
†	L. O. Garrett	51.48	19.84	16.56	10.88	6.28	1.13
†	H. L. Sturdivant	49.50	22.16	14.52	10.40	5.96	1.61
†	W. W. Buchanan	46.44	21.01	15.96	9.80	6.04	0.86
†	G. W. Brown	48.60	17.04	16.02	10.76	5.92	1.66
†	W. A. Graham	44.64	21.28	15.36	10.40	5.40	1.51
†	C. C. J. Norris	42.66	20.08	15.30	11.32	6.44	0.61
†	G. S. Welsh	45.90	18.80	15.06	10.12	5.36	1.47
†	R. O. Bitler	45.54	16.64	15.42	10.88	6.14	1.29
†	P. L. Drayton	41.94	18.56	14.88	13.24	5.78	1.63
†	Ambrose Cramer	44.46	16.72	14.46	10.28	7.20	1.17
†	G. B. French	41.76	18.48	16.26	10.56	5.10	1.06
†	W. J. Maxwell	39.60	17.84	15.54	10.16	5.20	0.36
†	Franklin Swift	a	a	a	a	5.28	0.37
†	H. C. Poundstone						
†	O. H. P. Belmont						
†	Ernest Wilkinson						
†	George E. Harrison						
†	John F. Luby						
†	W. N. King						
†	E. B. Webster						

MERIT-ROLLS FOR 1876-77.

Merit-rolls, made out yearly for each class, show the proficiency of the Cadets in each branch of study. The numbers given in the preceding table, showing the relative weight of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the Cadet for the year.

In the case of Cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 2.50.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

"Cadets who attain 85 per cent. of the multiple in any year shall be distinguished by a star affixed to their names on the merit-rolls."—(Regulations U. S. Naval Academy, § 150.)

Cadets whose names are marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

a denotes absence from examination.

CADET-MIDSHIPMEN.

Merit-roll of fourth class (84 members), annual examination, June, 1877—Continued.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Average.
	Maxima.....	36	24	8	8		76
1	John A. Perry.....	23.13	14.82	5.46	5.06	1.13	45.2
2	Wesley E. Best.....	22.05	13.62	5.06	6.30	0.50	45.0
3	Houston Eldredge.....	20.61	16.08	5.04	5.60	0.40	44.8
4	William F. Babcock.....	20.70	15.06	4.94	5.76	0.22	44.5
5	Louis J. Clark.....	23.85	12.36	4.98	5.70	1.04	45.0
6	Emile A. von Starkloff.....	18.81	14.52	7.14	6.08	1.61	41.9
7	Max A. Orlopp.....	20.88	13.74	4.70	5.34	1.12	44.1
8	John P. Porter.....	17.01	15.06	5.20	5.70	0.65	42.8
9	Edgar B. W. Haymond.....	20.70	12.54	5.48	4.92	1.34	42.8
10	Donnell Gilliam.....	17.91	14.76	4.92	4.38	1.34	40.8
11	John T. Wallace.....	18.18	11.88	4.34	5.46	0.56	38.8
12	Richard Jones.....	16.74	11.70	5.04	5.04	1.17	37.8
13	Herbert Bliss.....	18.18		a	6.70	1.58	
14	Edward C. Thompson.....	9.36	a	4.60	2.98	0.75	
15	Thomas B. Franklin.....						

CADET-MIDSHIPMEN.

Deficient sections of fourth class (34) members.

The following Cadets, having been turned back at the semi-annual examination have no relative position with the members of the fourth class:

† Andrews, H. B.	† Garland, J. S.	† Rodgers, G. G.
† Bellinger, O. H.	† George, C. P.	† Taylor, John, jr.
† Blow, G. P.	† Hains, R. P.	§ Thatcher, H. W.
§ Cooke, A. S.	† Lindsey, J. H.	§ Whitfield, J. G.
§ Conness, D. C. B.	† Mahoney, J. E.	§ Whitwell, S. E.
† Craig, B. H.	† Matthews, T. H.	† Will, J. P.
† Dent, Sydney H.	† Miner, J. R.	† Williamson, B. H.
† Deal, E. P.	† Parsons, A. C.	† Williamson, S. H.
† Doyen, C. A.	† Patterson, S. A. W.	† Wilson, H. B.
† Emmet, W. L.	† Reamer, M. M.	§ Wood, J. E.
Forshaw, R. P.	† Robinson, W. M.	† Wright, S. H.
† Foster, E. W.		

31	Frank B. Case	37.63	32.96	40.74	33.19	44.42	34.39	8.64	8.34	1.89	312.29	154.46	102.61	48.72	533.41
32	Frank W. Toppa	33.94	33.94	40.74	35.59	48.00	31.68	9.09	8.40	2.70	312.11	154.69	107.78	47.58	530.33
33	Harry M. Dombagh	34.44	34.32	42.84	31.92	43.60	31.68	2.43	7.93	4.03	314.34	146.01	102.89	51.33	534.66
34	Frank R. Heath	31.44	31.04	42.42	31.80	40.00	32.06	8.35	8.49	3.30	304.60	136.64	104.83	46.78	521.62
35	Philip V. Lansdale	33.72	31.44	43.36	32.70	43.76	30.96	8.07	7.69	3.43	310.33	139.23	103.36	50.55	516.83
36	William B. Benson	32.16	32.46	41.16	34.56	42.04	31.76	8.79	8.34	2.79	306.54	132.71	103.10	48.67	516.90
37	Perrival J. Werlich	31.92	30.64	45.36	34.40	43.53	33.30	9.21	8.52	4.17	313.03	150.94	103.10	48.67	513.74
38	William R. Rush	30.00	33.04	43.08	33.00	43.20	32.08	7.46	7.92	4.41	309.55	132.40	104.71	47.38	514.74
39	Horace W. Harrison	31.56	33.92	38.50	32.04	43.20	32.04	8.85	8.55	4.47	304.23	156.56	104.01	49.63	514.43
40	Alfred L. Hall	33.96	31.44	44.10	31.92	43.36	30.64	8.25	7.86	3.37	307.96	132.08	104.60	47.82	512.46
41	William L. Burdick	31.44	30.96	43.64	34.20	41.76	30.32	8.31	8.04	4.71	305.96	134.91	101.66	46.86	511.41
42	Henry A. Johnson	33.36	32.84	42.14	32.40	43.24	30.04	8.43	7.95	4.71	302.40	133.54	104.76	43.20	506.84
43	Simon Cook	29.01	27.84	38.64	31.68	44.32	30.56	7.77	8.22	1.32	305.37	143.75	101.89	46.62	499.32
44	Koroku Katz	30.84	19.20	38.36	31.68	38.84	14.88	.....	.....	2.53	189.49	12.75	82.53	43.61	419.39
45	Giro. Kuultomo	30.84	18.48	37.66	34.00	37.92	11.08	7.29	.....	1.41	166.46	131.23	83.71	47.38	418.78

CADET-ENGINEERS.

Merit-roll of fourth class (27 members), annual examination, June, 1877.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	
		36	24	8	8		
	Maxima						7
*1	W. F. C. Haddon	36.27	19.08	7.22	6.90	0.80	60
*2	A. W. Stahl	33.57	20.64	7.00	7.54	0.64	60
*3	L. D. Miner	33.03	17.58	5.52	7.14	0.18	61
*4	W. F. Durand	31.86	17.64	5.74	7.06	0.30	61
*5	W. S. Sample	30.33	17.76	5.20	6.94	0.30	62
*6	J. L. Wood	28.08	18.78	7.10	5.74	0.43	62
*7	A. T. Woods	27.09	18.26	6.26	7.30	0.21	63
*8	A. E. Smith	26.64	17.94	5.36	6.78	0.46	63
*9	A. O. Young	26.64	17.40	5.84	6.46	0.49	63
*10	T. W. Kinkaid	25.83	18.60	5.70	5.86	0.19	63
*11	W. H. Alderdice	27.00	17.52	5.24	7.08	1.15	63
*12	C. E. Manning	25.56	17.46	5.98	6.60	0.30	63
*13	C. A. King	25.47	17.82	5.40	6.04	0.60	64
*14	J. L. Worthington	24.93	16.44	6.24	5.74	0.33	64
*15	W. Lang	24.21	17.52	5.82	5.66	0.74	64
*16	C. A. Miller	25.11	16.38	5.00	5.94	1.41	64
*17	W. D. Weaver	22.95	17.58	5.74	6.08	1.19	64
*18	C. E. Belden	24.66	15.18	5.14	5.92	0.37	65
*19	C. H. Mathews	23.67	15.60	5.16	6.70	0.81	65
*20	F. M. Lillebridge	23.49	15.00	5.60	6.12	0.45	65
*21	Harry Hall	23.31	16.92	4.80	5.92	0.31	65
*22	Solon Arnold	20.79	18.24	5.92	5.56	0.28	65
*23	Arthur Nichols	22.95	14.40	6.08	6.65	0.44	65
*24	Herman Eckel	20.34	16.80	6.28	5.22	0.22	65
*25	J. E. Byrne	23.22	12.00	5.48	7.06	0.58	65
*26	H. J. Bailey	19.53	13.86	4.26	5.84	0.69	65
*27	A. W. Temple						

Harry K. Mumell	70.00	5.46	8.70	5.80	12.13	16.90	35.98	15.00	11.95	0.12	2.97	163.08
William P. White	26.04	6.30	2.25	6.29	11.40	16.06	40.74	15.00	10.00	7.99	1.36	161.19
George H. Stafford	24.40	6.14	0.37	6.02	10.30	15.33	30.70	15.00	11.32	7.99	2.12	153.51
James H. Hetherington	31.08	5.70	0.37	6.44	20.32	16.30	34.41	16.00	10.93	7.99	2.44	140.99
James C. Deut	32.84	5.34	0.33	5.94	17.30	15.00	33.98	15.75	10.32	7.99	1.09	147.46
John L. Merrill	32.16	5.46	7.32	5.68	16.04	15.00	34.41	13.75	11.95	7.71	2.47	146.40
Horatio H. Hooke	27.72	4.78	0.63	6.20	18.84	15.64	35.42	13.55	10.32	7.50		

posed of one of the medical officers of the Naval Academy, and two other medical officers to be designated by the Secretary of the Navy.

VIII. Any one of the following conditions will be sufficient to cause the rejection of a candidate:

- Greatly-retarded development;
- Feeble constitution, inherited or acquired;
- Permanently-impaired general health;
- Decided cachexia, diathesis, or predisposition;
- Chronic disease, or results of injuries sufficient to permanently impair efficiency such as—

- Weak or disordered intellect;
- Epilepsy, or other convulsions within five years;
- Impaired vision, or chronic disease of the organs of vision;
- Great dullness of hearing, or chronic disease of the ears;
- Chronic nasal catarrh, ozena, polypi, or great enlargement of the tonsils;
- Marked impediment of speech.
- Decided indications of liability to pulmonary disease;
- Chronic cardiac affections;
- Hernia, or retention of testes in inguinal cavity;
- Sarcocele, hydrocele, stricture, fistula, or hemorrhoids;
- Large varicose veins of lower limbs, scrotum, or cord;
- Chronic ulcers; cutaneous and communicable diseases;
- Unnatural curvature of the spine, torticollis, or other deformity;
- Permanent disability of either of the extremities or articulations from any cause.

Attention will also be paid to the stature of the candidate; and no one under size for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates who fail below the standard will receive a second and final examination in the subjects in which they fail. Deficiency in any one of the subjects at the second examination will be sufficient to insure rejection.

XI. Candidates rejected at such examinations shall not have the privilege of a second examination for admission to the same class unless recommended by the Board of Examiners."—(*Rev. Stat.*, § 1515.)

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is required to express in figures any whole number, decimal, or mixed number; to write in words any given number; and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; the number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of common fractions.

CADET-MIDSHIPMEN.

Merit-roll of fourth class (84 members), annual examination, June, 1877.

Order of annual merit	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Aggrgato.
	Maxima.....	36	24	8	8		76
1	Herman G. Dresel.....	35.91	20.94	7.44	7.46	0.36	71.39
2	Philip R. Alger.....	36.54	20.54	6.82	7.20	0.93	70.22
3	John B. Bernadou.....	32.85	20.88	7.26	7.36	0.65	67.70
4	William H. Wolfersberger.....	33.12	19.94	5.56	6.42	0.30	64.78
5	Luman S. Norton.....	33.39	19.20	5.64	6.78	0.82	64.19
6	James C. Drake.....	34.47	17.52	6.06	6.26	0.46	63.45
7	Patrick W. Hourigan.....	30.78	20.84	5.54	6.24	1.03	62.41
8	Horatio L. Fillebrown.....	31.23	18.12	6.06	7.26	0.42	62.25
9	Albert A. Ackerman.....	30.69	19.44	5.48	6.40	0.18	61.83
10	Edwards F. Leiper.....	24.44	18.54	6.16	6.56	0.04	59.62
11	James B. Murray.....	24.35	19.32	6.36	6.22	1.06	59.31
12	William Truxton.....	28.71	18.12	5.46	7.20	0.48	59.01
13	Frank W. Bowdon.....	27.99	19.08	6.40	5.48	0.38	58.57
14	Stokely Morgan.....	28.80	18.24	5.06	6.52	0.22	58.40
15	Arthur K. Howze.....	29.16	16.74	6.14	6.08	0.39	57.73
16	Augustus N. Meyer.....	28.53	18.06	5.40	6.12	0.56	57.55
17	Thomas A. Parke.....	27.09	18.30	6.90	5.56	0.41	57.44
18	George E. West.....	29.16	17.04	5.52	6.06	0.43	57.35
19	Henry M. Finley.....	28.98	16.80	6.20	6.22	1.16	57.04
20	Theodore G. Jewey.....	26.91	17.34	5.70	7.44	0.46	56.93
21	Porter D. Has ell.....	26.10	18.72	6.40	5.71	0.18	56.78
22	William C. P. Muir.....	26.37	17.82	6.62	6.40	0.72	56.49
23	Joseph H. Robracker.....	26.73	18.72	5.74	5.62	0.39	56.48
24	Manning K. Eyre.....	26.73	18.12	6.66	5.86	1.01	56.36
25	Edward D. Bronner.....	25.11	18.96	5.42	7.10	0.36	56.23
26	William E. Safford.....	25.02	18.06	6.26	6.84	0.34	55.84
27	Harry Phelps.....	29.34	16.04	5.76	5.78	1.14	55.82
28	Edward Simpson, Jr.....	26.37	17.82	5.82	5.94	0.24	55.71
29	James Gray.....	26.19	17.76	5.98	6.32	0.88	55.37
30	George L. Dillman.....	28.71	15.54	5.16	6.70	1.04	55.07
31	Con. M. Perkins.....	25.38	17.94	5.40	6.82	0.62	54.98
32	John S. Watters.....	27.18	16.20	5.72	6.42	0.67	54.85
33	Francis R. Wall.....	26.37	18.06	5.48	5.30	0.48	54.73
34	Fitz-Aubert Hantoon.....	27.00	17.04	5.36	6.22	0.98	54.64
35	Albert P. Niblack.....	24.21	18.96	5.60	6.12	0.40	54.49
36	Joseph M. Dickson.....	25.29	18.96	5.28	5.20	0.27	54.46
37	Louis Duncan.....	26.82	16.80	5.04	6.04	0.45	54.25
38	Charles Cabaniss.....	24.48	18.12	6.04	5.22	0.14	53.78
39	William H. Emerson.....	24.57	17.76	5.20	6.26	0.28	53.51
40	Howard H. Bullitt.....	25.92	17.10	5.22	5.66	0.40	53.50
41	John B. Bailey.....	24.93	17.34	5.96	5.34	0.53	53.04
42	James S. Brown.....	26.46	15.90	5.54	5.66	1.04	52.52
43	Alexander R. Hasson.....	24.75	16.38	5.88	6.22	1.22	52.41
44	Hugh Rodman.....	24.57	16.80	5.08	6.40	0.99	51.86
45	Paul R. Cooke.....	24.84	16.02	5.30	6.14	0.87	51.43
46	Louis S. Van Duzer.....	22.50	16.92	5.00	6.46	0.31	50.57
47	Henry B. Ashmore.....	22.77	16.62	6.04	5.82	1.12	50.13
48	Francis J. Haezler.....	23.40	15.66	5.10	6.90	1.00	50.06
49	Leonidas Levisse.....	23.13	15.84	5.36	6.16	0.43	50.06
50	Edward Brinley.....	22.50	15.90	5.56	5.40	0.62	49.74
	Henry C. Haines.....	25.92	17.64	4.90	7.24	0.79	54.91
	Richard H. Scott.....	26.55	16.98	4.78	6.08	0.46	53.93
	Frederick R. Brainard.....	26.19	15.48	4.98	6.00	0.24	53.31
	Washington Irving.....	22.77	17.70	6.48	5.54	0.84	51.65
	Francis L. Berkeley.....	22.14	16.08	6.24	6.54	0.56	50.44
	Charles H. Hill.....	26.37	16.50	5.02	5.38	2.84	50.43
	John C. Biddle.....	24.21	15.84	5.00	5.80	0.13	50.12
	William A. Gresham.....	22.95	15.54	5.04	6.82	0.34	50.01
	Walter G. Richardson.....	21.96	17.82	4.94	5.80	0.62	49.90
	Thomas L. Bon ils.....	24.03	16.26	5.16	5.20	1.12	49.53
	Alexander S. McCrea.....	20.70	16.86	6.08	6.44	0.88	49.20
	Thomas Worthington.....	23.58	15.78	4.72	5.20	0.72	49.16
	William S. Sims.....	22.05	15.54	4.96	7.22	0.78	48.99
	Edwin W. Nash.....	22.46	16.32	4.80	5.68	1.03	48.63
	Felton Parker.....	22.21	14.10	6.56	6.58	0.86	48.61
	George E. Perry.....	23.04	16.08	5.48	4.88	1.04	48.44
	Zebulon B. Vance.....	22.50	15.90	4.94	5.68	1.12	47.90
	Macdonough Craven.....	22.24	14.64	4.66	6.00	0.64	47.49
	Samuel Bryan.....	21.51	15.48	5.50	5.54	0.57	47.46

CADET-MIDSHIPMEN.

Merit-roll of fourth class (84 members), annual examination, June, 1877—Continued.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Average grade.
	Maxima	36	24	8	8		76
5	John A. Perry	23.13	14.82	5.46	5.06	1.15	6.22
4	Weasley E. Best	22.95	13.62	5.06	6.30	0.90	6.00
3	Houston Eldredge	20.61	10.02	5.04	5.60	0.86	5.65
2	William F. Babcock	20.70	15.06	4.94	5.76	0.92	6.17
1	Louis J. Clark	23.85	12.36	4.98	5.70	1.04	6.14
	Emile A. von Starkloff	18.81	14.52	7.14	6.08	1.61	6.11
	Max A. Orlopp	20.88	13.74	4.70	5.34	1.12	6.10
	John P. Porter	17.01	15.06	5.20	5.70	0.63	6.02
	Edgar B. W. Haymond	20.70	12.51	5.48	4.92	1.28	6.00
	Donnell Gilliam	17.01	14.76	4.92	4.38	1.34	5.93
	John T. Wallace	18.18	11.88	4.34	5.46	0.56	5.76
	Richard Jones	16.74	11.70	5.04	5.04	1.17	5.75
	Herbert Bliss	18.18		a	6.70	1.56	
	Edward C. Thompson	9.36	a	4.60	2.98	0.75	
	Thomas B. Franklin						

CADET-MIDSHIPMEN.

Deficient sections of fourth class (34) members.

The following Cadets, having been turned back at the semi-annual examination, have no relative position with the members of the fourth class:

† Andrews, H. B.	† Garland, J. S.	† Rodgers, G. G.
† Bellinger, O. H.	† George, C. P.	† Taylor, John, jr.
† Blow, G. P.	† Hains, R. P.	§ Thatcher, H. W.
§ Cooke, A. S.	† Lindsey, J. H.	§ Whitfield, J. G.
§ Conness, D. C. B.	† Mahoney, J. E.	§ Whitwell, S. E.
† Craig, B. H.	† Matthews, T. H.	† Will, J. F.
† Dent, Sydney H.	† Miner, J. R.	† Williamson, B. H.
† Deal, E. P.	† Parsons, A. C.	† Williamson, S. H.
† Doyen, C. A.	† Patterson, S. A. W.	† Wilson, H. B.
† Emmet, W. L.	† Reamer, M. M.	§ Wood, J. E.
Forshaw, R. P.	† Robinson, W. M.	† Wright, S. H.
† Foster, E. W.		

Room-mates will procure for their common use—

One looking-glass (half-cost).....	\$0 66	One broom (half-cost)	\$0 18
One water-pail (half-cost)	49	One table-cover (half-cost)	63
One slop-bucket (half-cost)	49		
Total			169 70

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home; but all other articles must conform to the regulations, and must, therefore, be supplied by the storekeeper.

XV. Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of \$50, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, in the purchase of text-books and other authorized articles, besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of \$50 must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing.....	\$169 70
Deposit for books, &c	50 00
Total deposit required.....	219 70

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XVI. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling-expenses.

R. W. THOMPSON,
Secretary of the Navy.

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

I. In pursuance of law, applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. The number of appointments which can be made is limited by law to twenty-five each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 5th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four academic years, with two additional years at sea. All cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer is the same as that of a Cadet-Midshipman, \$500 per annum, and at sea the same as Midshipmen.

V. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the first degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition; and geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those for the admission of Cadet-Midshipmen.

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.*—Description of all kinds of rope, and its practical manipulation for purposes on shipboard; measuring for and fitting standing and running rigging; tarring, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in case of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's *Seamanship*, with lectures and illustrations from models.

SHIP CONSTRUCTION.

Text-books.—Thearle's *Naval Architecture* and Wilson's *Ship-Building*, with lectures illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and manœuvring of a fleet, under full power of sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

NAVAL TACTICS.*—Exercises in boats under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal Code. The instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought-iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial velocity, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's *Naval Ordnance and Gunnery*; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.*—Organization and formation of squad, company, and battalion; drill of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet exercise.

Text-books.—United States Infantry Tactics; Wingate's *Rifle Practice*.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States ship *Santee*.

MORTAR-PRACTICE.

FENCING.—Exercise with small-swords and broadswords.

* Cadet-Midshipmen only.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and surd quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of Algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the application of the method, particularly to the projections of the sphere and the construction of maps.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections; Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display marked ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1877-78:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with applications to trigonometry and geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and schools; Todhunter's Theory of Equations; Rice and Johnson's Elements of the Differential and Integral Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and details of marine steam-engines, and of instruments and apparatus used in connection with them; the principles followed to insure strength in construction; the computation of the power and its cost; the duties of the engine-room watch, and of the engineer division.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, and the processes of manufacture.

DESIGNING OF MACHINERY.*—The designing and construction of engines and other machinery, and the motions employed in valve-gearing.

MECHANICAL DRAWING.*—The nomenclature of design and construction; general and conventional practices of the art; the execution of plans, elevations, and sections.

PRACTICAL EXERCISES.—The management of marine steam-apparatus; [the use of tools and machines; hand-work of the machine-shop, pattern-shop, smithery, boiler-shop, and foundry.]*

Text-books.—King's Practical Notes on the Steam-Engine; Northcott's Steam-Engine; Warren's Elements of Mechanical Drawing; Willis's Principles of Mechanism; Rankine's Steam-Engine and other Prime Movers; Zeuner's Valve-Motion.

* Cadet-Engineers only.

decimal fractions, and is expected to be able to give clearly the reasons for such processes, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetics.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school arithmetics. It is essential that the candidate shall be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance (attention is specially called to the rivers and bodies of water on which cities are situated); the course of a vessel in making a voyage between well-known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as treated in the common-school text-books, embracing the following subjects: The divisions of letters, and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for *comparing adjectives*; irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives, secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as, the difference between *my* and *mine*, between *thou* and *you*, and the various uses of *it*; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied: compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs*; the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflection of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense-endings and personal endings; *impersonal verbs*; the classification, formation, and comparison of

Text-books.—Rice and Johnson's Differential and Integral Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; and Rankine's Applied Mechanics.

ELECTIVE COURSE.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in integral calculus and analytical mechanics.

Text-books.—Williamson's Integral Calculus, and Wood's Analytical Mechanics.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.

International law :—rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii*; rights and duties of neutrals; contraband; blockade; right of search; ship's papers; offences against the law of nations.

Outlines of maritime law.

Lectures.

Text-books.—Woolsey's International Law; Andrews's Manual of the Constitution.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1875; historical geography; progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's General Sketch of History, with Labberton's Historical Atlas; Eliot's History of the United States, with modern atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology. Syntax; analysis of sentences.—Readings from standard authors, with applications of the principles of grammar, and exercises in analysis and in tracing the etymological meaning of words.—Classification of words; definition of words by usage and by derivation; synonyms; laws of change in the meaning of words by contraction, extension, and amelioration.—Faults in diction, and their remedies; selection and arrangement; elementary principles of reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Keutel's French Grammar; Howard's Aid to French Composition; Prud'homme's French Nautical Paraphrases; Erckmann-Chatrian's *Le Conscrit*; Gasché's Dictionary; Roget's Spanish Manual; Tolon's Reader; Barretti's Dictionary.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are arranged in four classes, each class pursuing the course for the year.

PROGRAMME OF RECITATIONS FOR THE FIRST TERM.

From September 20, 1877, to February 2, 1878.

The time devoted to daily recitations is divided into three periods, indicated thus:—(1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m.

Practical exercises begin on Saturday at 10.45 a. m., and on all other days, except Sundays, at 4 p. m.

CADET-MIDSHIPMEN.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
English Studies, History, and Law	M. T. W. Th. F. (1)	Elective Course once a week.
Modern Languages	1st division, M. T. Th. (3)	English and History.
Drawing	2d division, M. W. F. (3)	French.
	1st division, W. F. (3)	Line-drawing.
Drawing	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics	M. T. W. Th. F. (1)	Trigonometry and Descriptive
English Studies, History, and Law	F. (3)	Geom-try.
	M. F. (2) W. (3)	Descriptive Geometry.
Physics and Chemistry	T. W. Th. (2)	Elective Course once a week.
Modern Languages	T. Th. (3)	History and Rhetoric.
Drawing	M. (3) S. (1)	Elementary Physics.
		French.
		Sketching.
SECOND CLASS—THIRD YEAR.		
Seamanship	M. (3) F. (2) S. (1)	Luce's Seamanship.
Ordnance and Gunnery	Th. (3)	Infantry Tactics.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
English Studies, History, and Law	One period a month	Elective Course twice a week.
	M. T. (2) W. F. (3)	Composition.
Modern Languages		French.
FIRST CLASS—FOURTH YEAR.		
Seamanship	T. Th. F. (3)	Naval Construction.
Ordnance and Gunnery	T. (2) W. (3)	Ordnance and Armor.
Steam-Engineering	W. Th. (2) F. (1)	Marine Engines.
Astronomy, Navigation, and Surveying	M. T. W. Th. (1)	Navigation.
Physics and Chemistry	M. F. (2) S. (1)	Heat and Light.
Modern Languages	M. (3)	Spanish.

CADET-ENGINEERS.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
Steam-Engineering	1st division, W. F. (3)	Elective Course once a week.
English Studies, History, and Law	2d division, T. Th. (3)	Mechanical Drawing.
	M. T. W. Th. F. (1)	English and History.
Modern Languages	1st division, M. T. Th. (3)	French.
	2d division, M. W. F. (3)	

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

I. In pursuance of law, applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. The number of appointments which can be made is limited by law to twenty-five each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 5th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four academic years, with two additional years at sea. All cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer is the same as that of a Cadet-Midshipman, \$500 per annum, and at sea the same as Midshipmen.

V. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the first degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition; and geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those for the admission of Cadet-Midshipmen.

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

NSHIP.*—Description of all kinds of rope, and its practical manipulation for uses on shipboard; measuring for and fitting standing and running rigging; sparring, and rigging ship; getting on board and stowing a vessel's outfit; rig a ship's company; fittings of boats; management of boats under all circumstances of vessels at sea and in harbor; repair of spars and rigging in accident; duties of officers at sea and in port; rules of the road; wind and

ok.—Luce's Seaman's Ship, with lectures and illustrations from models.

CONSTRUCTION.

oks.—Thearle's Naval Architecture and Wilson's Ship-Building, with lectures aided by models and drawings.

TACTICS.*—Organization, formations, and manœuvring of a fleet, under sail.

oks.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

TACTICAL EXERCISES, consisting of—

NSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

TACTICS.*—Exercises in boats under oars and under sails.

s.—Exercises in the use of signals according to Myer's Army Signal Code. Instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

ICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

ation of gun-iron from crude ore, including the description and use of furnaces. Nature of wrought-iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fire-

of gunnery.—Motion of projectiles in *vacuo* and in the atmosphere; initial velocity, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; various systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles; and recoil of guns.

oks.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

TRY TACTICS.*—Organization and formation of squad, company, and battalion; drill of the soldier; company and battalion drill, including instructions for skirmish and the bayonet exercise.

oks.—United States Infantry Tactics; Wingate's Rifle Practice.

TACTICAL EXERCISES, consisting of—

TRY-DRILL.

ARTILLERY AND BOAT-HOWITZER EXERCISE.

GUNS.—Exercises and target-practice on board the United States ship Santee.

R-PRACTICE.

ga.—Exercise with small-swords and broadswords.

* Cadet-Midshipmen only.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and surd quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of Algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the application of the method, particularly to the projections of the sphere and the construction of maps.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections; Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display marked ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1877-78:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with applications to trigonometry and geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and schools; Todhunter's Theory of Equations; Rice and Johnson's Elements of the Differential and Integral Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and details of marine steam-engines, and of instruments and apparatus used in connection with them; the principles followed to insure strength in construction; the computation of the power and its cost; the duties of the engine-room watch, and of the engineer division.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, and the processes of manufacture.

DESIGNING OF MACHINERY.*—The designing and construction of engines and other machinery, and the motions employed in valve-gearing.

MECHANICAL DRAWING.*—The nomenclature of design and construction; general and conventional practices of the art; the execution of plans, elevations, and sections.

PRACTICAL EXERCISES.—The management of marine steam-apparatus: [the use of tools and machines; hand-work of the machine-shop, pattern-shop, smithery, boiler-shop, and foundry.]*

Text-books.—King's Practical Notes on the Steam-Engine; Northcott's Steam-Engine; Warren's Elements of Mechanical Drawing; Willis's Principles of Mechanism; Rankine's Steam-Engine and other Prime Movers; Zeuner's Valve-Motion.

* Cadet-Engineers only.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments, especially those used for determining terrestrial latitudes and longitudes.

Text-book.—C. J. White's *Astronomy*; *Theory of Portable Transit and Zenith Telescope*.

NAVIGATION.*—Theory and practice of navigation, the latter including instruction in the duties of the navigator, the use of navigating-instruments, and their construction, with the solution of problems and the use of tables.

Text-books.—Coffin's *Navigation*; Merrifield's *Deviation of the Compass*; Bowditch's *Navigator*.

SURVEYING.*—The form of the earth, with special reference to the construction of charts; explanation of geodetical surveys; the solution of problems in nautical surveying; and practical work in surveying and constructing charts.

Text-book.—Howell's *Marine Surveying*.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum-analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

CHEMISTRY.—General chemistry.

METEOROLOGY AND CLIMATOLOGY.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; effects of heat; instruments used for the measurement of heat; thermodynamics.

Text-books.—Stewart's *Elementary Physics*; Eliot and Storer's *Chemical Analysis*; Jenkin's *Magnetism and Electricity*; Stewart's *Elementary Treatise on Heat*; Miller's *Inorganic Chemistry*.

Reference-books.—Ganot's *Physics*; Maxwell's *Theory of Heat*.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima, and the tracing of curves; the methods of integration, and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work, and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriiform fluids.*—Laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

THE STRENGTH AND RESISTANCE OF MATERIALS.*—Strength and flexure of beams; beams of uniform resistance; results obtained by experimenters.

* Cadet-Midshipmen only.

† Cadet-Engineers only.

Text-books.—Rice and Johnson's Differential and Integral Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; and Rankine's Applied Mechanics.

ELECTIVE COURSE.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in integral calculus and analytical mechanics.

Text-books.—Williamson's Integral Calculus, and Wood's Analytical Mechanics.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.

International law:—rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii*; rights and duties of neutrals; contraband; blockade; right of search; ship's papers; offences against the law of nations.

Outlines of maritime law.

Lectures.

Text-books.—Woolsey's International Law; Andrews's Manual of the Constitution.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1875; historical geography; progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's General Sketch of History, with Labberton's Historical Atlas; Eliot's History of the United States, with modern atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology. Syntax; analysis of sentences.—Readings from standard authors, with applications of the principles of grammar, and exercises in analysis and in tracing the etymological meaning of words.—Classification of words; definition of words by usage and by derivation; synonyms; laws of change in the meaning of words by contraction, extension, and amelioration.—Faults in diction, and their remedies; selection and arrangement; elementary principles of reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Keutel's French Grammar; Howard's Aid to French Composition; Prud'homme's French Nautical Phrases; Erckmann-Chatrian's *Le Conscriit*; Gas's Dictionary; Roget's Spanish Manual; Tolon's Reader; Barretti's Dictionary.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

foregoing studies are distributed over four years, and the Cadets are arranged in classes, each class pursuing the course for the year.

PROGRAMME OF RECITATIONS FOR THE FIRST TERM.

From September 20, 1877, to February 2, 1878.

Time devoted to daily recitations is divided into three periods, indicated thus:—(1), (2), (3). (1) first period, from 8.30 a. m. to 10.30 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m. (3) denotes third period, from 2 p. m. to 4 p. m. Recitation exercises begin on Saturday at 10.45 a. m., and on all other days, except Sundays, at 4 p. m.

CADET-MIDSHIPMEN.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
History, and Law	M. T. W. Th. F. (1)	Elective Course once a week.
Languages	1st division, M. T. Th. (3)	English and History.
	2d division, M. W. F. (3)	French.
Engineering	1st division, W. F. (3)	Line-drawing.
	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics	M. T. W. Th. F. (1)	Trigonometry and Descriptive Geometry.
	F. (3)	Descriptive Geometry.
History, and Law	M. F. (2) W. (3)	Elective Course once a week.
Chemistry	T. W. Th. (2)	History and Rhetoric.
Languages	T. Th. (3)	Elementary Physics.
Engineering	M. (3) S. (1)	French.
		Sketching.
SECOND CLASS—THIRD YEAR.		
Midshipman	M. (3) F. (2) S. (1)	Luce's Seamanship.
Artillery and Gunnery	Th. (3)	Infantry Tactics.
Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Physics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
History, and Law	One period a month	Elective Course twice a week.
Languages	M. T. (2) W. F. (3)	Composition.
		French.
FIRST CLASS—FOURTH YEAR.		
Midshipman	T. Th. F. (3)	Naval Construction.
Artillery and Gunnery	T. (2) W. (3)	Ordnance and Armor.
Engineering	W. Th. (2) F. (1)	Marine Engines.
Navigation, and Surveying	M. T. W. Th. (1)	Navigation.
Chemistry	M. F. (3) S. (1)	Heat and Light.
Languages	M. (3)	Spanish.

CADET-ENGINEERS.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
		Elective Course once a week.
Engineering	1st division, W. F. (3)	Mechanical Drawing.
	2d division, T. Th. (3)	
History, and Law	M. T. W. Th. F. (1)	English and History.
Languages	1st division, M. T. Th. (3)	French.
	2d division, M. W. F. (3)	

CADET-ENGINEERS—Continued.

Department.	Periods.	Subjects.
THIRD CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1)	Trigonometry and Descriptive Geometry.
	F. (3)	Descriptive Geometry.
Steam Engineering	M. (3) S. (1)	Elective Course once.
Physics and Chemistry	T. W. Th. (2)	Mechanical Drawing.
English Studies, History, and Law	M. F. (2) W. (3)	Elementary Physics.
Modern Languages	T. Th. (3)	History and Rhetoric.
		French.
SECOND CLASS—THIRD YEAR.		
Steam-Engineering	M. Th. (3) F. (2) S. (1)	Mechanical Drawing, Engines, and Faint Machinery.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
English Studies, History, and Law	One period a month*	Elective Course twice.
Modern Languages	M. T. (2) W. F. (3)	Composition.
		French.
FIRST CLASS—FOURTH YEAR.		
Seamanship	T. Th. F. (3)	Naval Construction.
Steam-Engineering	M. T. W. Th. F. (1) W. (3)	Marine Engines, Faint and Designing of Machinery.
Physics and Chemistry	M. F. (2) S. (1)	Mechanical Drawing.
Mechanics and Applied Mathematics	T. W. Th. (2)	Heat and Light.
Modern Languages	M. (3)	Strength of Materials.
		Spanish.

* Theme Periods.—1. Sept. 22, S. (1), { C. M. Seamanship, } 2. Oct. 29, M. (1), Mechanics.
 26. M. (2), Modern Languages. 4. Dec. 26, W. (2), Navigation.

PROGRAMME OF RECITATIONS FOR THE SECOND TERM.

From February 2, 1878, to June 30, 1878.

CADET-MIDSHIPMEN.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
English Studies, History, and Law	M. T. W. Th. F. (1)	Elective Course once.
Modern Languages	1st division, M. T. Th. (3)	English and History.
	2d division, M. W. F. (3)	French.
Drawing	1st division, W. F. (3)	Topography.
	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics	M. T. W. Th. F. (1)	Analytical Geometry.
	M. (3)	Descriptive Geometry.
Physics and Chemistry	T. Th. F. (2)	Elective Course once.
English Studies, History, and Law	M. W. (2) S. (1)	Descriptive Geometry.
Modern Languages	T. W. Th. F. (3)	Chemistry.
		History and Rhetoric.
		French.
SECOND CLASS—THIRD YEAR.		
Seamanship	T. Th. (3) F. (2)	Luca's Seamanship.
Ordnance and Gunnery	Th. (2)	Naval Tactics.
Physics and Chemistry	T. (2)	Ordnance Instructions.
Mechanics and Applied Mathematics	M. W. (2) S. (1)	Physics.
	M. T. W. Th. F. (1)	Mechanics.
English Studies, History, and Law	One period a month	Elective Course twice.
Modern Languages	M. W. F. (3)	Composition.
		Spanish.

PROGRAMME OF STUDIES.

57

CADET-MIDSHIPMEN—Continued.

Department.	Periods.	Subjects.
FIRST CLASS—FOURTH YEAR.		
Seamanship	M. W. (2) S. (1)	Luce's Seamanship.
Ordnance and Gunnery	M. Th. (3) T. (1)	Ordnance and Armor.
Marine-Engineering	W. F. (3) Th. (2)	Marine Engines.
Astronomy, Navigation, and Surveying	M. W. Th. F. (1)	Navigation and Surveying.
English Studies, History, and Law	T. F. (2)	Public Law.
Modern Languages	T. (3)	Spanish.

CADET-ENGINEERS.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry. Elective Course once a week.
Marine-Engineering	1st division, W. F. (3)	Mechanical Drawing.
English Studies, History, and Law	2d division, T. Th. (3)	English and History.
Modern Languages	M. T. W. Th. F. (1)	French.
	1st division, M. T. Th. (3)	
	2d division, M. W. F. (3)	

THIRD CLASS—SECOND YEAR.

Mathematics	M. T. W. Th. F. (1)	Analytical Geometry and Descriptive Geometry. Elective Course once a week.
Physics and Chemistry	M. (3)	Descriptive Geometry.
English Studies, History, and Law	T. Th. F. (2)	Chemistry.
Modern Languages	M. W. (2) S. (1)	History and Rhetoric.
	T. W. Th. F. (3)	French.

SECOND CLASS—THIRD YEAR.

Marine-Engineering	T. Th. F. (2) T. Th. (3)	Mechanical Drawing, Fabrication of Machinery, and Marine Engines.
Physics and Chemistry	M. W. (2) S. (1)	Electricity.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Mechanics.
English Studies, History, and Law	One period a month	Elective Course twice a week.
Modern Languages	M. W. F. (3)	Composition.
		Spanish.

FIRST CLASS—FOURTH YEAR.

Marine-Engineering	M. W. Th. F. S. (1) W. Th. (3)	Marine Engines, Fabrication and Designing of Machinery, and Mechanical Drawing.
Physics and Chemistry	T. (1) M. W. (3)	Physical Measurements.
Mechanics and Applied Mathematics	M. (2)	Strength of Materials.
English Studies, History, and Law	T. F. (2)	Public Law.
Modern Languages	T. (3)	Spanish.

Theme Periods.—1. Feb. 8, F. (2), C. M. Seamanship. } 2. Mar. 11, M. (1), Mechanics. 3. Apr. 10, W.
 Modern Languages. 4. May 15, M. (2), Physics. } C. E. Steam.

THE UNIVERSITY OF MICHIGAN LIBRARIES

5
ANNUAL REGISTER

OF THE

96
大
UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

TWENTY-NINTH ACADEMIC YEAR,

1878-79.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1878.

THE UNIVERSITY OF MICHIGAN LIBRARIES

ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

TWENTY-NINTH ACADEMIC YEAR,

1878-79.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1878.

THE UNIVERSITY OF MICHIGAN LIBRARIES

GIFT
DEAN M. E. COOLEY
9-14-1905

CONTENTS.

	Page.
HISTORICAL SKETCH.....	4
BOARD OF VISITORS.....	5
ACADEMIC CALENDAR.....	6
CALENDAR, 1878-79.....	7
OFFICERS.....	8
ACADEMIC BOARD.....	11
CADET-OFFICERS.....	11
CADETS, WITH RELATIVE STANDING IN CLASSES.....	12
NUMERICAL SUMMARY.....	29
RESIGNATIONS, DISMISSALS, AND DEATHS.....	30
ANNUAL RIFLE-MATCH.....	31
PRACTICE-CRUISE, 1878.....	32
TABLE OF COEFFICIENTS.....	34
MERIT-ROLLS, 1877-78.....	37
REQUISITES FOR ADMISSION.....	49
COURSE OF INSTRUCTION.....	61
PROGRAMME OF RECITATIONS.....	66
EXAMINATION-PAPERS, 1877-78.....	69
INDEX.....	107

THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by Hon. George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The course was fixed at five years, of which the first and last only were spent at the School, the intervening three being passed at sea. This arrangement was not strictly adhered to, the exigencies of the service making it necessary, in many cases, to shorten the period of study. In January, 1846, four months after the opening of the School, the students consisted of 36 Midshipmen, of the date of 1840, who were preparing for the examination for promotion; 13 of the date of 1841, who were to remain until drafted for service at sea; and 7 Acting Midshipmen, appointed since September of the previous year. The Midshipmen of the date of 1840 were the first to graduate, finishing their limited course in July, 1846, and they were followed in order by the subsequent dates until the reorganization of the School, in 1851.

In September, 1849, a Board was appointed to revise the plan and regulations of the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. DuPont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation July 1, 1850.

The new organization provided for a course of seven years, the first two and last two at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, and its name was changed to the United States Naval Academy. The corps of professors was enlarged, the course was extended, and the system of separate departments, with executive heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Secretary of the Navy. A suitable vessel was attached to the Academy as a practice-ship, and the annual practice-cruises were begun.

After the system had been in operation a year new changes were proposed, and the recommendations of the Academic Board on the subject were referred to the Board of Examiners of the year 1851, composed of the following officers:

Commodore David Conner,
Captain Samuel L. Breese,
Commander C. K. Stribling,
Commander A. Bigelow,
Commander Franklin Buchanan,
Lieutenant Thomas T. Craven.

The change recommended by the Board of Examiners, and adopted by the Department, consisted mainly in leaving out the requirement of three years of sea-service in

the middle of the course, thus making the four years of study consecutive. The practice-cruises supplied the place of the omitted sea-service, and gave better opportunities of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in three years, and graduated in June, 1854; the rest of the class followed in 1855.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the frigates *Constitution* and *Santee*. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1865, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers were admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

BOARD OF VISITORS, JUNE, 1878.

Rear-Admiral JOHN L. WORDEN, U. S. N., *President*.

Brevet Major-General J. C. DAVIS, U. S. A., *Vice-President*.

Captain CLARK H. WELLS, U. S. N.

Honorable DANIEL S. PRINTUP, of Georgia.

Professor C. M. WOODWARD, Washington University, Saint Louis, Mo.

Honorable ALEXANDER BROWN, South Carolina.

Colonel ISAAC H. REED, New York.

W. H. PARKER, President of Maryland Agricultural College.

Chief-Engineer B. F. ISHERWOOD, U. S. N.

Reverend G. M. T. WRIGHT, Minnesota.

Honorable JOHN HANCOCK, Texas.

P. O. HOOPER, M. D., Arkansas.

Captain K. R. BREESE, U. S. N.

Reverend A. WHEELER, LL.D., Pennsylvania.

Brevet Major-General WAGER SWAYNE, U. S. A.

ACADEMIC CALENDAR.

1878-79.

1878.		
Oct.	1.—Beginning of first term.....	Tuesday.
1879.		
Jan. 27-Feb. 1.	—Semi-annual examination.....	Monday-Saturday.
Feb.	1.—End of first term.....	Saturday.
June	2-10.—Annual examination	Monday-Tuesday.
June	10.—End of academic year 1878-79.....	Tuesday.
June	11.—Examination of candidates for admission as Cadet-Midshipmen	Wednesday.
Sept.	15.—Examination of candidates for admission as Cadet-Engineers.....	Monday.
Sept.	22.—Examination of candidates for admission as Cadet-Midshipmen.....	Monday.
Oct.	1.—Beginning of first term 1879-80	Wednesday.

The academic months end on the following days:

1878-79.

October	Nov. 2	February	Mar. 1
November	Nov. 30	March	Mar. 29
December	Dec. 28	April	April 26
January	Jan. 25	May	May 23

CALENDAR FOR 1878-79

SEPTEMBER.							MARCH.						
Sun.	M.	T.	W.	T.	F.	Sat.	Sun.	M.	T.	W.	T.	F.	Sat.
1	2	3	4	5	6	7	-----	-----	-----	-----	-----	-----	1
8	9	10	11	12	13	14	2	3	4	5	6	7	8
15	16	17	18	19	20	21	9	10	11	12	13	14	15
22	23	24	25	26	27	28	16	17	18	19	20	21	22
29	30	-----	-----	-----	-----	-----	23	24	25	26	27	28	29
-----	-----	-----	-----	-----	-----	-----	30	31	-----	-----	-----	-----	-----
OCTOBER.							APRIL.						
-----	-----	1	2	3	4	5	-----	-----	1	2	3	4	5
6	7	8	9	10	11	12	6	7	8	9	10	11	12
13	14	15	16	17	18	19	13	14	15	16	17	18	19
20	21	22	23	24	25	26	20	21	22	23	24	25	26
27	28	29	30	31	-----	-----	27	28	29	30	-----	-----	-----
NOVEMBER.							MAY.						
-----	-----	-----	-----	-----	1	2	-----	-----	-----	1	2	3	-----
3	4	5	6	7	8	9	4	5	6	7	8	9	10
10	11	12	13	14	15	16	11	12	13	14	15	16	17
17	18	19	20	21	22	23	18	19	20	21	22	23	24
24	25	26	27	28	29	30	25	26	27	28	29	30	31
DECEMBER.							JUNE.						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31	-----	-----	-----	-----	29	30	-----	-----	-----	-----	-----
JANUARY.							SEPTEMBER.						
-----	-----	-----	1	2	3	4	-----	1	2	3	4	5	6
5	6	7	8	9	10	11	7	8	9	10	11	12	13
12	13	14	15	16	17	18	14	15	16	17	18	19	20
19	20	21	22	23	24	25	21	22	23	24	25	26	27
26	27	28	29	30	31	-----	28	29	30	-----	-----	-----	-----
FEBRUARY.							OCTOBER.						
-----	-----	-----	-----	-----	-----	1	-----	-----	-----	1	2	3	4
2	3	4	5	6	7	8	5	6	7	8	9	10	11
9	10	11	12	13	14	15	12	13	14	15	16	17	18
16	17	18	19	20	21	22	19	20	21	22	23	24	25
23	24	25	26	27	28	-----	26	27	28	29	30	31	-----

OFFICERS OF THE UNITED STATES NAVAL ACADEMY

COMMODORE F. A. PARKER,
SUPERINTENDENT.

COMMANDER S. D. GREENE,
Senior Aid to the Superintendent.

LIEUTENANT H. PERKINS.
Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER F. V. MCNAIR,
Commandant of Cadets.

LIEUTENANT W. H. BROWNSON,
Assistant to the Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER E. M. SHEPARD,
Head of Department.

LIEUTENANT-COMMANDER C. V. GRIDLEY,
LIEUTENANT-COMMANDER C. J. TRAIN
LIEUTENANT W. H. EMORY,
LIEUTENANT L. C. LOGAN,
Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,
Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER A. T. MAHAN,
Head of Department.

LIEUTENANT J. C. SOLEY,
LIEUTENANT W. H. PARKER, JR.,
LIEUTENANT J. W. MILLER,
LIEUTENANT DUNCAN KENNEDY,
Instructors in Naval Gunnery, and Infantry Tactics.

ANTOINE J. CORBESIER,
Sword-Master.

JEAN B. RETZ,
GEORGE HANSEN,
Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR W. W. HENDRICKSON,
Head of Department.

LIEUTENANT-COMMANDER F. W. DICKINS,
LIEUTENANT SOCRATES HUBBARD, A. M.,
LIEUTENANT R. R. INGERSOLL,
LIEUTENANT S. C. PAINE,
LIEUTENANT H. O. RITTENHOUSE,
MASTER G. L. DYER,
MASTER C. W. BARTLETT,
ENSIGN A. C. HODGSON,

Instructors in Mathematics.

STEAM-ENGINEERING.

CHIEF ENGINEER J. P. SPRAGUE,
Head of Department.

PASSED ASSISTANT ENGINEER L. W. ROBINSON, C. E., M. M. E.,
PASSED ASSISTANT ENGINEER C. H. GREENLEAF,
PASSED ASSISTANT ENGINEER W. L. NICOLL,
PASSED ASSISTANT ENGINEER DAVID JONES,
PASSED ASSISTANT ENGINEER C. H. MANNING,
PASSED ASSISTANT ENGINEER G. H. KEARNY,
ASSISTANT ENGINEER A. V. ZANE,

Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

COMMANDER J. A. HOWELL,
Head of Department.

LIEUTENANT-COMMANDER A. D. BROWN,
LIEUTENANT W. J. BARNETTE,
LIEUTENANT C. G. BOWMAN,

Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

COMMANDER W. T. SAMPSON,
Head of Department.

LIEUTENANT-COMMANDER W. M. FOLGER,
PROFESSOR H. D. TODD,
MASTER S. A. STAUNTON,
ENSIGN A. A. MICHELSON,
PROFESSOR N. M. TERRY, A. M., PH. D.,
PROFESSOR C. E. MONROE, S. B.,

Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR J. M. RICE, S. B.,
Head of Department.

LIEUTENANT M. R. S. MACKENZIE,
LIEUTENANT S. W. VEHY,
LIEUTENANT HARRY KNOX,

Instructors in Mechanics and Applied Mathematics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR J. R. SOLEY, A. B.,
Head of Department.

LIEUTENANT J. M. MILLER,
LIEUTENANT F. M. WISE,
LIEUTENANT J. V. B. BLEECKER,
LIEUTENANT R. T. JASPER,
LIEUTENANT G. W. TYLER,
MASTER C. H. LYMAN,
MASTER C. R. MILES,
ASSISTANT PROFESSOR W. W. FAY, A. M.,

Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,

Head of Department.

LIEUTENANT R. C. DERRY,
LIEUTENANT A. B. SPEYERS,
LIEUTENANT A. P. NAZRO,
MASTER AARON WARD,
MASTER W. P. CLASON,
ASSISTANT PROFESSOR A. V. S. COURCELLE,
ASSISTANT PROFESSOR EUGENE DOVILLIERE,
ASSISTANT PROFESSOR JULES LEROUX,
ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,

Head of Department.

ASSISTANT PROFESSOR C. E. BLAUVELT, N. A.,

Instructor in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

COMMANDER MERRILL MILLER, *In Charge of Practice Ships.*
MEDICAL INSPECTOR A. L. GIBON, A. M., M. D.
PASSED ASSISTANT SURGEON W. A. CORWIN, M. D.
PASSED ASSISTANT SURGEON G. E. HARMON, M. D.
PASSED ASSISTANT SURGEON E. H. GREEN, M. D.
ACTING ASSISTANT SURGEON T. O. WALTON, M. D.
PAYMASTER A. S. KENNY, A. R., *Commissary.*
PAYMASTER F. H. SWAN, *Storekeeper.*
PAYMASTER W. N. WATMOUGH, *Treasurer.*
CHAPLAIN ROBERT HUDSON, M. A.
ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
J. J. GRAFF, *Assistant Librarian.*
R. M. CHASE, *Secretary.*

MARINE GARRISON.

CAPTAIN G. P. HOUSTON, *Commanding.*

FIRST LIEUTENANT S. H. GIBSON,

SECOND LIEUTENANT S. J. LOGAN.

BOATSWAIN C. E. HAWKINS.

GUNNER ROBERT SOMMEHS.

MATES.

C. J. MURPHY.....	} Attached to the United States Gunwery-ship <i>Sea</i> and to the Sloop-of-war <i>Dale</i> .
SAMUEL GEE.....	
WILLIAM G. SMITH.....	
L. M. MELCHER.....	
ROBERT SILVER.....	} Attached to the United States Steamer <i>Nesbit</i> (iron-clad).
BENJAMIN G. PERRY.....	
JOSEPH RODGERS.....	} Attached to the United States Steamer <i>Flores</i> (sloop tender).

ACADEMIC BOARD.

COMMODORE F. A. PARKER, U. S. N.
 COMMANDER F. V. McNAIR, U. S. N.
 COMMANDER J. A. HOWELL, U. S. N.
 COMMANDER A. T. MAHAN, U. S. N.
 COMMANDER W. T. SAMPSON, U. S. N.
 COMMANDER E. M. SHEPARD, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 CHIEF ENGINEER J. P. SPRAGUE, U. S. N.
 PROFESSOR J. M. RICE, S. B., U. S. N.
 PROFESSOR J. R. SOLEY, A. B., U. S. N.
 PROFESSOR L. F. PRUD'HOMME, A. M.
 PROFESSOR MARSHAL OLIVER.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER.

RANDOLPH H. MINER.

CADET-LIEUTENANTS.

T. SNOWDEN.
J. M. MOORE.

C. C. MARSH.
L. O. GARRETT.

CADET-MASTERS.

E. E. HAYDEN.
C. H. HARLOW.

L. M. GARRETT.
H. S. CHASE.

R. S. SLOAN, *Adjutant*.

CADET-ENSIGNS.

A. C. CUNNINGHAM.
J. P. CAHOON.

R. P. SCHWERIN.
G. W. BROWN.

CADET-PETTY-OFFICERS.

First Captains of Gun's Crews.

E. H. Tillman.
J. A. Mudd.
W. A. Thom.
A. E. Clements.

D. P. Menefee.
G. S. Welsh.
J. A. Dougherty.
P. L. Drayton.

C. W. Jangen.
J. B. Blish.
J. H. Gibbons.
W. A. Gill.

C. S. Ripley.
J. Gibson.
H. Wike.
H. J. Robinson.

Second Captains of Gun's Crews.

R. Bitler.
E. Wilkinson.
J. A. Bell.
W. J. Sears.

R. F. Lopez.
L. H. Barnard.
W. A. Graham.
M. L. Read.

P. R. Alger.
H. G. Dresel.
L. S. Norton.
J. B. Bernadou.

W. H. Wolfersberger.
A. A. Ackerman.
P. W. Hourigan.
H. Phelps.

CADET-PASSED-ASSISTANT-ENGINEER.

H. P. NORTON.

CADET-ASSISTANT-ENGINEERS.

G. R. SALISBURY.

H. S. ELSEFFER.

Cadet-Machinists.

B. C. Bryan.
J. W. Annan.

J. U. Crygier.
F. M. Bennett.

E. O'C. Acker.
W. M. McFarland.

C. B. Lubbe.
R. T. Isbester.

CADET-MIDSHIPMEN.

Graduating class of 1878—36 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Naval construction.	Ordnance.	Marine engines.	Navigation.	Light and heat.	Law.	Spanish.			Months.	Days.
1	Fillmore, John Hudson	Illinois	Sept. 24, 1874	17	10	2	2	2	1	5	2	3	11	51		5	18
2	Rodgers, Thomas Slidell	At large	Sept. 24, 1874	16	1	6	6	3	5	1	4	1	1	51		5	18
3	Quinby, John Gardner	At large	June 12, 1874	14	10	3	5	3	2	7	1	10	16	108		5	18
4	McClain, Charles Sumner	Indiana	Nov. 2, 1874	17	2	4	8	1	2	1	7	6	6	86		5	18
5	Glennon, James Henry	California	Sept. 24, 1874	17	7	32	9	18	6	6	4	12	3	62		5	18
6	Knapf, Harry Shepard	Connecticut	June 26, 1874	18	0	13	15	9	7	11	10	2	7	125		5	18
7	Sprague, Frank Julian	Massachusetts	Sept. 29, 1874	17	2	8	1	6	4	8	3	13	20	132		5	18
8	Smith, Roy Campbell	Virginia	Oct. 3, 1874	16	2	16	12	16	11	12	14	21	14	40		5	18
9	Rodgers, William Ledyard	California	June 11, 1874	14	4	15	18	7	9	3	9	15	15	89		5	7
10	Wood, Albert Norton	Indiana	Sept. 24, 1873	16	6	1	3	10	12	9	10	19	13	53		5	26
11	Ruse, Harry McLaren Pinkney	New York	Sept. 30, 1874	15	10	31	21	13	12	17	12	3	2	82		5	18
12	Ormsby, George Francis	Ohio	Sept. 24, 1873	17	4	25	4	20	21	27	18	15	5	57		5	26
13	Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3	11	17	21	24	10	22	3	16	56		7	26
14	Lloyd, Edward, Jr.	Maryland	June 17, 1874	16	11	12	14	3	14	13	20	14	33	57		5	18
15	Holcombe, John Hitt Lee	Georgia	June 27, 1874	17	9	13	7	8	22	23	26	6	37	21		5	18
16	Hughes, Richard Morris	Pennsylvania	Sept. 23, 1874	12	8	28	10	20	20	19	4	8	4	114		5	18
17	Hubb, Peyton Brough	Alabama	June 12, 1874	17	3	9	20	11	14	25	16	10	18	33		5	18
18	Wright, Robert Kemp	Pennsylvania	June 12, 1873	14	6	5	11	14	10	22	26	22	10	83		7	26

		At large	Sept. 23, 1873	16	1	30	31	28	25	34	29	30	12	60	7	26
24	Stanford, George Henry	Iowa	June 10, 1874	17	11	19	25	12	17	30	28	17	18	40	5	18
25	White, William Porter	At large	June 30, 1874	15	5	17	34	24	32	26	19	33	21	128	5	18
26	Clark, George Ramsey	Ohio	June 9, 1874	17	3	10	19	29	17	23	13	18	23	111	5	18
27	Sparhawk, George	Massachusetts	Sept. 24, 1874	17	6	18	26	21	31	21	34	28	32	105	5	18
28	Craven, John Eckelston	At large	Sept. 24, 1874	15	10	27	28	26	27	15	26	33	30	107	5	18
29	Shipley, John Henry	Missouri	Sept. 30, 1874	16	6	21	23	30	26	27	23	31	27	87	5	18
30	Rogers, Allen Grey	North Carolina	June 12, 1874	14	6	21	13	15	30	19	21	24	26	123	6	18
31	Knapp, John Joseph	Missouri	June 9, 1874	16	8	35	33	33	36	18	31	20	36	87	5	18
32	Todd, Wilson Lemuel	Pennsylvania	June 5, 1873	15	1	19	36	34	27	33	23	25	30	134	3	18
33	Hooke, Horatio Hill	Illinois	Sept. 26, 1874	17	0	23	28	19	33	35	31	25	23	119	5	18
34	Hetherington, James Henry	Iowa	June 9, 1874	17	7	34	27	32	35	32	33	36	29	122	5	18
35	Dent, Balue Caruthers	At large	June 5, 1873	16	7	25	31	34	19	31	25	32	23	128	7	27
36	Almy, Augustus Craven	At large	June 6, 1872	15	6	36	35	36	34	36	35	35	33	104	9	12

14 CADET-MIDSHIPMEN, FIRST CLASS—RELATIVE STANDING

CADET-MIDSHIPMEN. First class—41 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—										Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Semanship.	Naval tactics.	Ordnance instructions.	Infantry tactics.	Astronomy.	Electricity.	Calculus and mechanics.	English composition.	French.	Spanish.		Months.	Days.
37	Barnard, Louis Hull	Colorado	June 13, 1874	16	11	25	20	32	30	37	37	39	38	24	36	194	4	19
34	Pell, John Arthur	West Virginia	June 13, 1874	16	11	41	15	29	39	36	17	25	41	38	38	142	4	19
34	Bittler, Reuben Oscar	Pennsylvania	June 10, 1875	16	1	40	33	40	37	39	39	33	35	29	33	173	2	19
38	Blish, John Bell	Indiana	Sept. 15, 1875	15	0	15	9	19	13	11	1	7	26	6	10	123	4	19
8	Brown, Guy Warner	Indiana	June 10, 1875	17	2	27	22	22	33	23	22	32	40	26	24	133	4	19
30	Cahoon, James Blake	Vermont	June 10, 1874	17	6	9	11	13	18	21	19	21	15	32	24	101	4	19
19	Chase, Henry Sanders	Louisiana	June 21, 1875	16	10	14	18	10	10	5	4	6	8	9	4	216	4	19
5	Clements, Abner Brush	Missouri	June 21, 1875	17	6	17	6	16	6	2	2	1	4	15	12	117	4	19
23	Cunningham, Andrew Chase	New York	June 9, 1874	16	4	16	9	15	1	28	33	37	23	34	26	47	4	19
23	Dougherty, John Allen	Missouri	June 12, 1874	16	9	35	19	35	29	38	27	21	29	40	21	76	4	19
32	Drayton, Percival Langdon	At large	June 10, 1874	16	2	28	27	25	41	28	26	24	17	4	32	191	4	19
20	Garrett, Le Roy Mason	New York	Sept. 16, 1875	18	0	9	4	9	12	9	6	9	11	1	2	86	4	19
7	Garrett, Leigh Osborn	Illinois	Sept. 13, 1875	15	1	4	1	33	16	18	14	25	36	20	15	156	4	19
17	Gibbons, John Henry	Michigan	Sept. 15, 1875	16	8	30	29	19	26	31	31	34	3	28	16	193	4	19
20	Gibson, John	Kentucky	Feb. 10, 1874	18	0	25	12	30	17	11	24	17	38	38	28	85	4	19
18	Gill, William Andrew	Pennsylvania	June 21, 1875	16	5	26	12	38	36	10	0	15	11	18	18	182	4	19
20	Graham, William Alfred	New York	Sept. 28, 1874	14	11	39	41	30	34	42	41	41	20	36	40	174	4	19
13	Hartow, Charles Henry	New York	Sept. 15, 1875	17	0	3	17	8	7	15	20	17	22	10	9	182	4	19
22	Hayden, Edward Everett	Massachusetts	June 21, 1875	16	11	12	8	6	28	4	7	4	1	9	1	61	4	19

16 CADET-MIDSHIPMEN, SECOND CLASS—RELATIVE STANDING.

CADET-MIDSHIPMEN.

Second class—66 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.		Months.	Days.
6	Ackerman, Albert Ammerman.....	New Jersey.....	June 21, 1876.....	16	11	9	2	12	28	18	92	2	18
7	Alger, Philip Ronseville.....	At large.....	Sept. 11, 1876.....	17	0	1	3	2	2	25	108	2	18
48	Asmore, Henry Beckwith.....	At large.....	Oct. 3, 1876.....	15	4	47	45	49	35	51	258	2	18
63	Bailey, John Bellamy.....	Florida.....	Sept. 15, 1875.....	16	7	64	64	49	50	64	206	2	18
22	Beale, Joseph.....	Pennsylvania.....	Oct. 12, 1874.....	14	10	23	15	13	26	58	239	2	18
49	Belmont, Oliver Hazard Perry.....	New York.....	Sept. 30, 1874.....	14	10	58	36	59	8	45	268	2	19
4	Bernadon, John Baptiste.....	At large.....	Sept. 12, 1876.....	17	10	5	7	9	4	1	169	2	18
30	Bowdon, Frank Welch.....	Texas.....	Sept. 11, 1875.....	17	7	42	40	4	21	57	109	2	18
32	Brainard, Frederick Roland.....	Illinois.....	June 21, 1876.....	17	9	26	33	52	45	13	126	2	18
56	Brinley, Edward.....	At large.....	Sept. 18, 1876.....	16	3	50	59	48	61	52	97	2	18
55	Brown, James Stephen.....	Tennessee.....	Sept. 11, 1875.....	17	2	44	58	56	48	58	264	2	18
5	Buchanan, Wilson Wildman.....	Ohio.....	June 19, 1875.....	17	3	.....	.....	.....	.....	.....	81	2	19
59	Bullitt, Howard Henry.....	Kentucky.....	Sept. 11, 1875.....	17	11	51	62	49	58	55	100	2	18
33	Cabaniss, Charles.....	Virginia.....	June 21, 1876.....	16	8	45	40	11	11	50	23	2	18
43	Clark, Lewis Jacob.....	Alabama.....	Sept. 11, 1876.....	14	7	40	32	43	54	38	214	2	18
62	Cooke, Paul Pyram.....	At large.....	Sept. 13, 1874.....	16	4	69	65	62	51	52	240	2	18
42	Cramer, Ambrose.....	Maryland.....	Sept. 28, 1874.....	17	6	34	55	56	51	15	154	2	19
46	Dewey, Theodore Gibbs.....	South Carolina.....	June 19, 1875.....	16	0	52	55	45	38	19	221	2	18
29	Dickson, Joseph Morrill.....	Texas.....	June 14, 1876.....	15	5	21	33	7	22	61	60	2	18
13	Dillman, George Lincoln.....	Iowa.....	June 10, 1876.....	16	1	11	21	33	16	10	139	2	18
34	Dodge, James Calhoun.....	Arkansas.....	June 10, 1875.....	17	11	14	36	43	56	32	160	2	18
	Don George.....	Ohio.....	Sept. 13, 1876.....	17	0	3	1	2	1	2	138	2	18

CADET-MIDSHIPMEN.
Second class—66 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.			Months.	Days.
45	Swift, Franklin.....	Massachusetts.....	June 9, 1874.....	16	1	46	39	41	58	49	194		2	19
53	Truxton, William.....	At large.....	June 21, 1876.....	15	3	27	33	14	67	4	194		2	18
56	Van Duzer, Louis Sayre.....	New York.....	Sept. 13, 1876.....	15	3	38	8	19	64	10	133		2	18
58	Wall, Francis Richardson.....	Mississippi.....	June 23, 1876.....	16	11	29	36	17	29	40	135		2	18
18	Watters, John Sproston.....	At large.....	June 21, 1876.....	14	11	22	26	15	17	8	185		2	18
64	Webster, Edwin Belden.....	Connecticut.....	Sept. 28, 1874.....	16	6	67	67	67	65	56	307		2	18
10	West, George Ernest.....	New York.....	Sept. 12, 1876.....	14	5	8	8	31	17	43	105		2	18
9	Wilkinson, Ernest.....	Louisiana.....	June 19, 1875.....	17	2	16	4	20	9	21	218		2	19
5	Woltersberger, William Henry.....	Illinois.....	Sept. 12, 1876.....	17	7	4	11	9	23	15	94		2	18
44	Worthington, Thomas.....	Alabama.....	June 19, 1876.....	16	7	43	55	47	23	42	166		2	18

§ Turned back from the first class.

Third class—85 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and History.	French.	Drawing.		Months.	Days.
15	Andrews, Horace Burlingame.	Michigan	June 22, 1876	15	1	12	22	9	26	48	2	0
21	Balcock, William Frederick.	Louisiana	Sept. 19, 1876	15	8	16	21	29	46	37	2	0
24	Ballentine, Henry Laird.	Tennessee	June 20, 1877	16	6	25	11	14	75	122	2	0
62	Barnett, George.	Wisconsin	June 19, 1877	17	6	65	41	74	70	43	2	0
51	Blow, George Preston.	Virginia	Sept. 14, 1876	15	11	56	61	60	16	133	2	0
1	Bonfis, Thomas Lewis.	Missouri	June 19, 1875	17	8						0	0
19	Bryan, Samuel.	Maryland	June 14, 1876	17	3	26	17	15	20	127	2	0
69	Buck, Guy Morville.	Maine	Sept. 11, 1877	16	10	70	73	69	78	48	2	0
35	Bunts, Frank Emory.	Ohio	June 20, 1877	16	1	36	37	39	41	37	2	0
29	Capelhart, Edward Everett.	Ohio	June 22, 1877	17	11	44	17	13	63	22	2	0
9	Carroll, Eugene.	At large	June 19, 1877	16	2	6	15	23	29	129	2	0
60	Clarke, George.	Illinois	June 22, 1877	14	11	58	70	69	45	94	2	0
41	Cockle, Rudolphus Rouse.	Illinois	June 21, 1875	17	8	35	29	29	37	280	2	0
53	Cohen, Harry Radcliffe.	At large	June 20, 1877	15	4	63	46	43	25	19	2	0
49	Colwell, James Hunn.	At large	June 20, 1877	16	10	52	34	56	63	50	2	0
78	Cooke, Abbott Stanislaus.	Illinois	June 26, 1877	17	11	73	73	63	16	221	0	0
47	Craig, Ben Holliday.	Missouri	June 14, 1876	16	8	42	40	29	82	139	2	0
46	Craven, Macdonough.	New York	June 21, 1876	17	7	51	59	49	7	298	2	0
54	Crenshaw, James Davis.	Texas	Sept. 11, 1877	17	10	53	67	32	54	33	2	0
11	Dashell, Robert Brooke.	At large	June 19, 1877	16	11	25	4	5	3	22	2	0
66	Darmally, Michael Joseph.	Wisconsin	June 21, 1877	17	7	67	57	61	57	163	2	0
14	Doyen, Charles Augustus.	New Hampshire	June 21, 1876	16	9	13	19	10	8	100	2	0
48	Presser, James Walter.	Minnesota	June 21, 1877	16	8	44	51	66	39	168	2	0

CADET-MIDSHIPMEN.

Third class—85 members.—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.		Months.	Days.
10	Eldridge, Houston	At large	Oct. 2, 1876	15	7	10	12	12	22	115	2	0
42	Emmet, William LeRoy	At large	June 26, 1876	16	11	42	41	63	9	200	2	0
76	Enoyne, Yonoke	Empire of Japan	Sept. 18, 1877	19	...	79	82	...	67	9	0	0
25	Flainroy, William Francis	Louisiana	June 19, 1877	17	9	11	30	43	72	188	2	0
68	Ford, William Grilling	Arkansas	Sept. 11, 1877	15	7	56	76	73	62	176	2	0
79	Forrest, Rufordford Worster	New York	Sept. 12, 1877	16	2	89	77	47	79	325	0	0
37	Forsbaw, Robert Pierpont	New York	June 21, 1876	16	11	22	7	26	46	53	2	0
56	Foster, Edward West	Tennessee	June 21, 1876	16	1	49	60	55	61	278	2	0
36	George, Charles Penslee	Illinois	July 1, 1876	16	3	32	37	54	15	127	2	0
5	Gresham, William Albert	Indiana	June 19, 1875	17	3	...	...	...	...	...	0	0
71	Gunley, Revere Randolph	District of Columbia	Sept. 11, 1877	16	1	...	...	...	65	292	0	0
8	Haines, Henry Cargill	At large	June 26, 1875	15	7	8	19	24	4	100	2	0
40	Hains, Robert Peter	Maine	Sept. 18, 1876	16	3	47	41	49	10	181	2	0
64	Harrison, Eugene Marion	Ohio	June 20, 1877	17	10	60	32	58	50	237	2	0
52	Harrison, Edward Hanson	At large	June 21, 1877	15	10	53	44	75	42	53	2	0
1	Hasson, Alexander Ritchie	At large	June 21, 1875	15	4	...	...	...	...	...	0	0
4	Hoogewert, John Adrian	At large	June 21, 1877	16	7	5	12	26	24	67	2	0
22	Hunlike, Felix Herman	Missouri	Sept. 11, 1877	17	6	41	26	5	1	48	2	0
16	Karamny, Lincoln	Pennsylvania	Sept. 12, 1877	17	0	27	7	16	23	59	2	0
55	Kass, Spencer Mettler	Illinois	Sept. 11, 1877	17	10	66	44	43	27	54	2	0
61	Kimball, John Arthur	Massachusetts	Sept. 12, 1877	17	0	62	65	59	37	111	2	0
28	Lachbuer, Charles Henry	Maryland	Sept. 11, 1877	17	11	35	24	4	65	169	2	0
63	Lindsay, John Howard	Pennsylvania	June 21, 1876	16	3	54	63	66	67	238	2	0

12	Linnard, Joseph Hamilton	Pennsylvania	June 21, 1877	16	0	4	6	36	21	169	2	0
	Mahoney, James Edward	Massachusetts	Sept. 12, 1876	16	9	22	1	8	19	92	2	0
30	Mathews, Thomas Henry	Pennsylvania	Sept. 12, 1876	16	1	32	24	16	30	250	2	0
18	McCrea, Alexander Sterling	At large	Oct. 2, 1876	17	2	28	10	7	11	241	2	0
65	McMakin, Ira	Pennsylvania	June 20, 1877	17	4	74	50	72	56	20	2	0
75	McKee, Llewellyn Thomas	Pennsylvania	June 20, 1877	17	0	74	77	80	72	157	0	0
70	Morgan, Daniel	Kentucky	Sept. 11, 1877	17	10	70	75	77	80	203	2	0
50	Moses, Franklin James	South Carolina	Sept. 11, 1877	16	9	48	46	24	52	244	2	0
73	Oliphant, Alexander Coulter	New Jersey	Sept. 12, 1877	17	5	78	68	47	48	96	2	0
45	Ordrup, Max Anton	Arkansas	June 19, 1876	17	1	34	57	22	59	252	0	0
34	Parker, Felton	Iowa	Nov. 6, 1876	16	0	40	55	1	13	301	2	0
31	Parsons, Arthur Carlton	Iowa	June 21, 1876	17	11	22	46	34	33	154	2	0
5	Perkins, Con Marnet	Georgia	Sept. 11, 1875	14	11	.....	.....	.....	.....	235	2	18
5	Perry, George Ernest	Illinois	Sept. 12, 1876	10	10	.....	.....	.....	.....	451	0	0
26	Pierce, Byron Gilmore	Illinois	June 21, 1877	17	4	35	14	39	39	89	2	0
72	Porter, John Pryor	Texas	Sept. 11, 1875	16	2	70	53	42	76	113	2	0
50	Printup, David Lawrence	New York	June 21, 1877	17	5	56	69	63	43	189	2	0
*2	Rees, John Levermore	Michigan	June 21, 1877	17	4	2	2	19	2	72	2	0
7	Rider, Frederick Clinton	Rhode Island	Sept. 12, 1877	17	6	6	15	49	12	45	2	0
43	Robinson, William Moody	At large	June 23, 1876	17	4	44	31	66	36	198	2	0
38	Rodgers, Gray George	Tennessee	Sept. 23, 1876	14	1	19	39	26	77	232	2	0
58	Russell, William Worthington	At large	Sept. 12, 1876	17	9	63	35	3	83	209	2	0
*1	Schock, John Loomis	Pennsylvania	June 19, 1877	17	4	1	3	10	5	55	2	0
5	Serata, Tassicker	Empire of Japan	Sept. 12, 1877	19	0	3	27	49	54	27	2	0
32	Smies, Frederick William	Ohio	June 23, 1877	16	0	35	51	36	5	63	2	0
37	Stanton, William Henry	Delaware	June 21, 1877	16	3	31	23	59	67	135	2	0
33	Stewart, Charles West	Illinois	June 21, 1877	17	10	35	35	49	33	103	2	0
13	Sutton, Francis Eskridge	New York	June 21, 1877	16	6	15	5	2	71	84	2	0
20	Urin, Sotokichi	Empire of Japan	Sept. 12, 1877	10	0	16	28	19	14	7	2	0
5	Vance, Zebulon Baird	North Carolina	June 22, 1876	16	0	.....	.....	.....	.....	246	2	18
67	Weeks, John Wingate	New Hampshire	June 21, 1877	17	2	67	63	78	51	57	2	0
97	Weller, Ovington Eugene	Maryland	Sept. 12, 1877	15	7	55	55	61	74	151	2	0
23	White, Harry Kidder	Dakota	Sept. 13, 1877	17	6	16	32	21	39	32	2	0
74	Wilkes, Gilbert	Utah	Sept. 12, 1877	14	0	74	77	46	53	158	2	0

CADET MIDSHIPMEN.

Third class, 85 members—Continued.

Order of annual merit	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—				Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Drawing.			Months.	Days.
77	Will, James Frederick.....	Iowa.....	Sept. 11, 1876	17	3	60	53	39	30	50	0	0	0
44	Williamson, Samuel Hill.....	North Carolina.....	Sept. 11, 1876	17	10	28	61	56	50	243	2	0	0
27	Wilson, Henry Brail.....	New Jersey.....	Sept. 11, 1876	15	7	14	46	34	44	270	2	0	0
6	Woodward, Joseph Janvier.....	At large.....	June 21, 1877	16	9	0	9	16	18	45	2	0	0
33	Wright, Silas Haynes.....	Michigan.....	June 28, 1876	17	10	20	66	33	28	119	2	0	0

§ Turned back from the second class.

† Reinstated.

CADET-MIDSHIPMEN.

Fourth class—76 members.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
win Alexander.....	North Carolina.....	June 21, 1878	17	11
Thompson.....	Wyoming Territory.....	Sept. 27, 1877	17	10
.....	Kentucky.....	June 21, 1878	16	8
.....	New York.....	Sept. 23, 1878	17	2
el Elmore.....	Pennsylvania.....	Sept. 23, 1878	17	5
Nelson.....	Tennessee.....	Aug. 23, 1877	17	11
s Slocum.....	New Jersey.....	Sept. 11, 1877	15	9
Bunch.....	North Carolina.....	Sept. 11, 1877	16	7
Joseph.....	Alabama.....	June 21, 1878	15	10
nes Franklin.....	Indiana.....	Sept. 12, 1878	15	7
Joseph.....	New York.....	Sept. 11, 1877	17	10
ton Wesley.....	Iowa.....	June 21, 1878	16	7
Hope.....	At large.....	Sept. 11, 1876	15	7
.....	New York.....	Sept. 23, 1878	17	10
Gregory.....	Pennsylvania.....	June 21, 1877	17	1
es Jackson.....	Georgia.....	Sept. 11, 1877	17	0
am Butler.....	New York.....	Nov. 1, 1878	16	6
l Hayden.....	Maine.....	June 21, 1878	14	6
Roy Mason.....	Virginia.....	June 21, 1878	15	8
liam Bartlett.....	Vermont.....	Sept. 11, 1877	15	8
mond.....	Virginia.....	Sept. 23, 1878	16	7
mas Baber.....	Tennessee.....	Sept. 15, 1875	17	11
omas Heywood.....	Georgia.....	Sept. 23, 1878	15	7
am Jacob.....	Pennsylvania.....	Sept. 11, 1877	15	5
Theodore.....	North Carolina.....	May 8, 1878	18	0
ice Sangston.....	Mississippi.....	June 21, 1878	16	11
as Warren.....	Massachusetts.....	Sept. 11, 1877	16	8
Frederick.....	Missouri.....	June 21, 1878	17	2
.....	Kentucky.....	Sept. 11, 1877	16	4
August.....	Alabama.....	June 21, 1878	17	5
am Lauriston.....	Connecticut.....	Sept. 11, 1877	17	8
hamiel Mead.....	At large.....	Sept. 11, 1877	17	6
Lee.....	Mississippi.....	June 21, 1878	15	1
bury.....	Georgia.....	Sept. 23, 1878	17	9
an Henry.....	Minnesota.....	June 21, 1878	17	5
y.....	Montana Territory.....	Sept. 12, 1877	17	0
Edward.....	New York.....	June 21, 1877	16	10
enoir.....	Tennessee.....	June 21, 1877	16	11
Alcus.....	Mississippi.....	June 21, 1877	17	5
nder Brown.....	South Carolina.....	Mar. 20, 1878	18	0
nk Felix Emile.....	Michigan.....	June 21, 1878	14	4
ee.....	Louisiana.....	June 21, 1878	16	3
o Norton.....	Pennsylvania.....	Sept. 11, 1877	16	9
y Alexander.....	Indiana.....	Sept. 11, 1877	16	9
acob Gray.....	Georgia.....	Sept. 12, 1877	16	2
ey Zollieoffer.....	Alabama.....	Sept. 23, 1878	16	6
lice.....	Ohio.....	June 21, 1876	15	10
Gnox.....	Indiana.....	Sept. 23, 1878	17	5
r Ellis.....	Pennsylvania.....	June 20, 1877	16	6
.....	Virginia.....	June 21, 1878	17	2

CADET-MIDSHIPMEN, FOURTH CLASS.

CADET-MIDSHIPMEN.

Fourth class—76 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mo.
Norton, Oliver Dwight	Ohio	June 21, 1877	17	1
Paine, Walter Taylor	Ohio	Sept. 11, 1877	14	1
Patterson, Samuel Achmuty Wainwright	At large	June 21, 1876	18	
Phillips, Patrick Henry	Maryland	June 21, 1878	17	
Phythian, Charles Taylor	Kentucky	June 19, 1877	16	
Poyer, John Martin	At large	June 21, 1877	15	
Prince, Thomas Clayton	Ohio	June 21, 1878	17	
Rankin, Harry	Kansas	June 21, 1878	15	
Reynolds, Charles Roberts	Arizona Territory	June 21, 1878	15	
Reckets, William Wallace	Virginia	Sept. 23, 1878	17	
Salisbury, Smith	New York	Sept. 23, 1878	16	
Savage, Ledru Rollin	Illinois	Sept. 23, 1878	17	
Semple, Lorenzo	Alabama	Sept. 11, 1877	16	
Schrader, George Morrison Von	Missouri	Sept. 23, 1878	16	
Slack, William Yarnall	Missouri	June 19, 1877	16	
Smyth, James Wilson	New York	June 19, 1877	16	
Smith, Thomas Buchanan	Alabama	June 21, 1878	17	
Solomon, Edward Everett	Georgia	Sept. 17, 1878	18	
Stable, Frederick Henry	California	Sept. 11, 1877	15	
Sturphen, Edson Webster	Nebraska	June 21, 1878	17	
Taylor, John	Kentucky	Jan. 15, 1876	17	
Weeks, Edwin Babbitt	Oregon	Sept. 23, 1878	15	
Whittelsey, William Bailey	New York	June 21, 1878	17	
Wickes, Joseph Lee	Pennsylvania	Sept. 11, 1877	14	
Wood, Spencer Shepard	New York	June 21, 1878	16	
Woods, Robert Harris	Virginia	Sept. 23, 1878	17	

CADET-ENGINEERS—RELATIVE STANDING.

25

CADET-ENGINEERS.

Graduating class of 1878—14 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Sea-service in practice-ships.	
				Years.	Months.	Naval construction.	Steam-engineering.	Light and heat.	Physical measurements.	Mechanics.	Law.	Spanish.	Number of demerits.	Months.	Days.
1	Hollis, Ira Nelson	Kentucky	Oct. 1, 1874	18	6	2	1	3	1	2	3	4	86	4	27
2	Schell, Franklin Jacob	Pennsylvania	Oct. 1, 1874	17	1	2	3	1	3	2	1	2	28	4	27
3	Spangler, Henry Wilson	Pennsylvania	Oct. 1, 1874	16	9	1	2	2	2	1	3	6	107	4	27
4	Bull, Gould Hoyt	Pennsylvania	Oct. 1, 1874	18	4	8	6	4	7	4	6	5	125	4	27
5	Griffin, Robert Stanislaus	Virginia	Oct. 1, 1874	17	0	6	5	6	12	4	5	1	56	4	27
6	McElroy, George Wightman	Michigan	Oct. 1, 1874	16	6	5	8	10	5	6	10	14	147	4	27
7	Cooley, Mortimer Elwyn	New York	Oct. 1, 1874	19	6	4	4	11	10	13	8	9	66	4	27
8	Bartlett, Frank William	Michigan	Oct. 1, 1874	18	1	10	7	14	6	14	8	3	119	4	27
9	Bieg, Frederick Charles	Missouri	Oct. 1, 1874	18	6	7	8	9	7	8	4	3	76	4	27
10	Gage, Howard	Michigan	Oct. 1, 1874	18	1	14	13	7	14	10	10	10	117	4	27
11	Whiner, Joseph Ringgold	Maryland	Oct. 1, 1874	29	10	12	14	8	13	7	7	6	99	4	27
12	Gow, John London	Indiana	Oct. 1, 1874	18	4	11	12	12	4	11	12	13	73	4	27
13	Wight, Charles Leslie	Massachusetts	Oct. 1, 1874	21	1	13	8	5	11	9	13	12	130	4	27
14	Burd, George Eli	Massachusetts	Oct. 1, 1874	17	5	8	11	12	9	11	14	10	97	4	27

CADET-ENGINEERS.
First class—23 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Steam-engineering.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Spanish.		Months.	Days.
9	Acker, Edward O'Connor.....	Pennsylvania.....	Sept. 15, 1875.....	17	4	13	5	4	10	5	15	11	40	5	20
10	Annan, John Wesley.....	Massachusetts.....	Sept. 15, 1875.....	19	0	6	14	13	17	4	7	10	161	5	20
21	Baker, John Howard.....	Rhode Island.....	Sept. 15, 1875.....	18	0	15	22	21	20	22	19	16	181	5	20
15	Bennett, Frank Marion.....	Michigan.....	Oct. 1, 1874.....	17	5	17	10	17	12	13	16	17	154	5	20
18	Bevington, Martin.....	Ohio.....	Sept. 15, 1875.....	17	10	19	20	18	15	12	22	20	84	5	20
23	Bowles, Francis Tiffany	Massachusetts.....	Sept. 15, 1875.....	16	11	1	2	4	3	10	5	4	89	5	20
19	Bowers, Frederic Clay.....	New Jersey.....	Sept. 15, 1875.....	17	7	22	13	14	15	16	9	7	166	5	20
4	Bryan, Benjamin Chambers.....	New Jersey.....	Sept. 15, 1875.....	17	1	11	4	7	4	11	6	6	54	5	20
5	Carr, Clarence Alfred.....	Pennsylvania.....	Sept. 15, 1875.....	19	1	8	5	3	7	1	4	5	68	5	20
22	Cartor, Thomas Frederic.....	Kentucky.....	Oct. 1, 1874.....	18	3	20	22	14	22	15	20	23	64	5	20
16	Crygier, John Ulysses.....	New York.....	Oct. 1, 1874.....	16	6	12	17	18	18	6	10	13	139	5	20
14	Elsecker, Harry Smith.....	Iowa.....	Oct. 1, 1874.....	19	3	10	11	22	21	13	11	15	139	5	20
22	Gatewood, Richard	Virginia.....	Sept. 15, 1875.....	15	11	5	3	2	2	2	3	41	3	21	
8	Hunt, Andrew Murray.....	Indiana.....	Sept. 15, 1875.....	16	2	7	7	12	8	8	3	1	134	5	20
12	Isabeter, Richard Thornton.....	Tennessee.....	Sept. 15, 1875.....	18	3	18	15	9	9	5	16	12	8	4	27
7	Ivera, Henry King.....	Missouri.....	Oct. 1, 1874.....	18	6	9	9	8	5	6	9	8	14	97	5
6	Labbe, Charles Bethel.....	Pennsylvania.....	Sept. 15, 1875.....	18	3	3	8	6	6	9	8	14	97	5	20
21	McFarland, Walter Martin	District of Columbia.....	Sept. 15, 1875.....	16	1	3	1	1	1	1	7	1	2	72	5
11	Norton, Harold Perelval.....	New York.....	Oct. 1, 1874.....	18	10	2	18	10	13	22	23	19	74	5	20
23	Pickrell, Joseph McCall.....	Virginia.....	Oct. 1, 1874.....	17	2	22	19	16	23	21	21	17	170	3	9
20	Salisbury, George Robert.....	Missouri.....	Oct. 1, 1874.....	19	7	20	10	18	18	18	14	12	82	5	20
17	Seymour, Edward Henshell.....	Massachusetts.....	Oct. 1, 1874.....	19	11	14	21	22	13	18	16	22	53	5	20
13	Talcott, Charles Gratford.....	Virginia.....	Sept. 15, 1875.....	16	0	15	11	19	11	13	13	9	124	5	20

Order of annual examina- tion.	Name.	State.	Date of ad- mission.	examina- tion.		Mathematics.	Physics and chemistry.	History and composition.	French.	Mechanical drawing.	Number of demer- its.	practice- ships.	
				Years.	Months.							Months.	Days.
8	Alderdice, William Hillary	Pennsylvania	Sept. 14, 1876	16	9	8	0	4	11	4	244	6	18
18	Belden, Charles Emory	Ohio	Sept. 14, 1876	18	6	16	19	18	18	16	72	2	18
25	Durand, William Frederick	Connecticut	Sept. 14, 1876	17	6	2	2	5	6	3	114	2	18
1	Dungan, Horace Greely	Iowa	Oct. 1, 1874	20	6								9
12	Hall, Harry	Pennsylvania	Sept. 14, 1876	17	9	10	14	13	8	19	72	2	18
22	Hasson, William Frederick Converse	Ohio	Sept. 14, 1876	19	4	1	3	3	2	5	109	2	18
1	Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10								20
14	King, Charles Alfred	Maryland	Sept. 14, 1876	18	1	13	10	8	16	17	125	2	18
11	Kinkaid, Thomas Wright	Ohio	Sept. 14, 1876	16	6	14	4	6	10	18	50	2	18
20	Lillebridge, Frederic May	Connecticut	Sept. 14, 1876	17	9	20	20	19	19	10	241	2	18
19	Manning, Charles Edward	New York	Sept. 14, 1876	17	6	12	5	10	11	8	152	2	18
16	Mathews, Clarence Herbert	Ohio	Sept. 14, 1876	19	7	17	15	16	14	15	162	2	18
21	Miller, Clarence Alexander	Virginia	Oct. 27, 1875	18	11								18
4	Miner, Leo Dwight	Ohio	Sept. 14, 1876	17	7	4	7	11	15	7	71	2	18
7	Sample, Winfield Scott	Pennsylvania	Sept. 14, 1876	18	10	5	13	14	13	9	83	2	18
13	Smith, Albert Edward	Wisconsin	Sept. 14, 1876	17	8	11	15	9	17	6	169	2	18
19	Smith, William Strother	Virginia	Sept. 15, 1875	18	0	17	18	20	20	13	90	2	20
19	Stahl, Albert, William	New York	Sept. 14, 1876	19	4	3	1	1	3	1	100	2	18
11	Weyer, William Dixon	Pennsylvania	Sept. 14, 1876	19	1	15	9	14	9	20	298	3	18
15	Wood, Joseph Learned	Virginia	Sept. 14, 1876	20	2	7	12	2	1	14	86	2	18
6	Woods, Arthur Tammatt	Massachusetts	Sept. 14, 1876	17	7	6	8	12	5	2	129	2	18
5	Worthington, John Leeds	Maryland	Sept. 14, 1876	18	3	19	17	17	4	21	73	2	18
17	Young, Albert Osborn	New York	Sept. 14, 1876	19	2	9	11	7	7	11	95	2	18

) Reinstated.

CADET-ENGINEERS.

Third class—28 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Seaservice in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Mechanical drawing.	Number of demerits.	Months.	Days.	
15	Anderson, Martin Augustus....	Wis ..	Sept. 13, 1877	19	11	16	17	13	3	115	3		
4	Arnold, Solon	Md ..	Sept. 14, 1876	22	2	8	3	3	14	92	3		
19	Bankson, Lloyd.....	Penn ..	Sept. 13, 1877	19	9	19	21	19	9	94	3		
22	Beach, Robert James.....	N. Y..	Sept. 13, 1877	19	16	23	20	17	7	256	3		
12	Bush, Arthur Richmond.....	Mass ..	Sept. 13, 1877	17	4	10	22	14	5	154	3		
3	Byrne, James Edwin.....	Mass ..	Sept. 14, 1876	19	5	2	10	12	2	163	3		
26	Day, Willis Bunner.....	Ohio ..	Sept. 13, 1877	19	10	26	25	23	25	123	3		
13	Dowst, Frank Butland.....	Mass ..	Sept. 13, 1877	18	3	16	10	4	18	97	3		
8	Eckel, Herman.....	Ohio ..	Sept. 14, 1876	20	2	13	4	2	13	95	3		
10	Gartley, William Henry.....	Penn ..	Sept. 13, 1877	18	1	11	7	18	11	225	3		
1	Kaemmerling, Gustave.....	Ind ...	Sept. 13, 1877	19	3	1	8	9	10	93	3		
†	Lang, William.....	N. Y..	Sept. 14, 1876	18	8					6			
25	McAllister, Andrew.....	N. Y..	Sept. 13, 1877	19	3	27	18	24	21	156	3		
16	McAlpine, Kennett.....	Va. .	Sept. 13, 1877	17	0	19	6	7	22	193	3		
28	McCreary, Harry Raynor.....	Md ...	Sept. 13, 1877	17	7	25	23	25	20	125	3		
23	Moritz, Albert.....	N. Y..	Sept. 13, 1877	17	2	23	28	16	19	138	3		
6	Nichols, Arthur.....	N. Y..	Sept. 14, 1876	19	5	9	5	6	1	165	3		
14	Parsons, Isaac Brown.....	Mich ..	Sept. 13, 1877	17	8	11	15	27	6	165	3		
21	Perkins, Lyman Burnham.....	Conn ..	Sept. 13, 1877	18	7	15	25	20	17	94	3		
17	Redgrave, DeWitt Clinton.....	Md ...	Sept. 13, 1877	19	2	14	24	8	14	102	3		
11	Sampson, Bias Clay.....	Ill ...	Sept. 13, 1877	19	6	6	14	16	26	104	3		
7	Shallenberger, Oliver Blackburn	Penn ..	Sept. 13, 1877	17	4	5	13	11	4	69	3		
18	Smith, William Stuart.....	N. Y..	Sept. 13, 1877	19	8	18	12	27	12	100	3		
5	Stewart, jr., Robert.....	Mich ..	Sept. 13, 1877	19	5	7	1	5	23	79	3		
20	Webster, William Townsend....	N. Y..	Sept. 13, 1877	20	1	21	15	22	8	203	3		
24	White, William Wilmot.....	Penn ..	Sept. 13, 1877	17	11	22	27	26	28	152	3		
9	Whitham, Jay Manuel.....	Ill ...	Sept. 13, 1877	19	0	3	9	21	16	52	3		
2	Whittle, Llewellyn Fairfax.....	Va. .	Sept. 13, 1877	18	9	3	1	1	20	103	3		

† Turned back from the second class.

CADET-ENGINEERS.

Fourth class—28 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
Roberts	Pennsylvania	Oct. 1, 1878	17	5	24
Sam Henry	Pennsylvania	Oct. 1, 1878	19	11	9
Henry	Rhode Island	Oct. 1, 1878	18	1	12
Edward	New York	Oct. 1, 1878	16	8	5
Henry	Massachusetts	Oct. 1, 1878	19	5	22
Sam Henry Paul	Ohio	Oct. 1, 1878	19	2	1
Harry	Virginia	Oct. 1, 1878	17	7	2
Robert	Connecticut	Oct. 1, 1878	19	3	10
Woodland	Virginia	Oct. 1, 1878	16	9	4
Demarest	New Jersey	Sept. 13, 1877	18	1	18
Charles	New Jersey	Oct. 1, 1878	19	0	8
Ernest Leroy	Kentucky	Oct. 1, 1878	19	9	7
Barnard	Maryland	Oct. 1, 1878	20	0	11
Henry	Rhode Island	Oct. 1, 1878	17	5	16
Alvin	Ohio	Oct. 1, 1878	19	3	17
Harold	Ohio	Oct. 1, 1878	19	6	18
.....	Kansas	Oct. 1, 1878	18	7	13
Henry	Pennsylvania	Oct. 1, 1878	18	3	3
Franker	Massachusetts	Sept. 13, 1877	19	8	25
Henry	New York	Oct. 1, 1878	17	7	15
Edward	Pennsylvania	Oct. 1, 1878	16	2	14
Lakin	Pennsylvania	Oct. 1, 1878	17	3	19
Alexander Wharton	Maryland	Oct. 1, 1878	18	4	25
Kenyon	Massachusetts	Oct. 1, 1878	18	8	21
.....	Wisconsin	Oct. 1, 1878	17	11	6
Calhoun	Mississippi	Oct. 1, 1878	19	0	20
Philo	Ohio	Oct. 1, 1878	19	5	23
.....	Empire of Japan	Sept. 21, 1878	19	11	.....

SUMMARY.

November 1, 1878.

CADET-MIDSHIPMEN.

.....	41 members.
.....	66 members.
.....	85 members.
.....	76 members.
	268

CADET-ENGINEERS.

.....	23 members.
.....	23 members.
.....	28 members.
.....	28 members.
	102

370

the Empire of Japan are received for instruction under a resolution of the Senate and representatives of the United States approved July 27, 1868.

RESIGNATIONS AND DEATHS.

October 1, 1877, to November 1, 1878.

RESIGNATIONS.

Cadet-Midshipman E. D. Bronner	Oct.	1, 1877
Cadet-Midshipman C. Pleasants	Oct.	5, 1877
Cadet-Midshipman W. B. Whittelsey	Nov.	9, 1877
Cadet-Midshipman J. S. Garland	Nov.	10, 1877
Cadet-Engineer A. W. Temple	Feb.	6, 1878
Cadet-Midshipman W. E. Best	Mar.	8, 1878
Cadet-Midshipman G. E. Harrison	April	24, 1878
Cadet-Midshipman M. Jackson	April	30, 1878
Cadet-Midshipman P. Baily	May	20, 1878
Cadet-Midshipman W. N. King, jr	May	20, 1878
Cadet-Midshipman O. H. Bellinger	May	20, 1878
Cadet-Midshipman G. A. Scott	May	25, 1878
Cadet-Midshipman A. J. Jones	June	8, 1878
Cadet-Midshipman E. P. Deal	Sept.	4, 1878

DEATHS.

Cadet-Engineer M. D. Noell, at York, Pa.	Jan.	1, 1878
Cadet-Midshipman J. B. Murray, at New York City	Aug.	11, 1878

REINSTATED.

Cadet-Midshipman John Taylor	Dec.	11, 1877
Cadet-Midshipman J. P. Porter	Dec.	13, 1877
Cadet-Midshipman Ambrose Cramer	Feb.	13, 1878
Cadet-Engineer W. Strother Smith	Feb.	25, 1878
Cadet-Midshipman J. L. Purcell	July	3, 1878
Cadet-Engineer T. J. Hogan	July	3, 1878
Cadet-Midshipman T. L. Bonfils	Aug.	14, 1878
Cadet-Midshipman A. R. Hasson	Aug.	14, 1878
Cadet-Engineer H. G. Dungan	Sept.	30, 1878

ANNUAL RIFLE-MATCH

BETWEEN MEMBERS OF THE GRADUATING CLASS, JUNE 10-20, 1878.



Target showing score of C. N. Atwater.

TERMS OF THE MATCH.

Target, that adopted by the National Rifle
Association of 1875.
Distance, 400 yards.
Rifle, Remington Navy.

Position, that of a skirmisher lying down
Number of shots, 7.
Possible score, 35.

Name.	1.	2.	3.	4.	5.	6.	7.	Total.
C. N. Atwater	4	4	5	5	5	4	5	32
W. C. Canfield	5	3	5	5	5	5	4	32
J. G. Quinby	5	5	4	5	5	3	5	32
A. C. Almy	5	5	3	5	4	4	5	31
J. H. Fillmore	5	2	5	5	3	5	5	30
Total								157

Average score of class..... 21.6

SUMMER CRUISE, 1878.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION

Commander H. L. HOWISON, *Commanding*.
 Lieutenant-Commander C. V. GRIDLEY, *Executive Officer*.
 Lieutenant-Commander C. J. TRAIN, *Instructor in Navigation*.
 Lieutenant W. H. EMORY, *Navigator*.
 Lieutenant R. C. DERBY, *Watch-Officer*.
 Master H. O. RITTENHOUSE, *Watch-Officer*.
 Master G. L. DYER, *Watch-Officer*.
 Master A. WARD, *Watch-Officer*.
 Ensign A. C. HODGSON, *Watch-Officer*.
 Surgeon, E. C. VER MEULEN.
 Assistant Surgeon, W. H. RUSH.
 Paymaster, A. S. KENNY.
 Chaplain, ROBERT HUDSON.
 Boatswain, C. E. HAWKINS.
 Gunner, ROBERT SOMMERS.
 Clerk to Commandant of Cadets, C. M. McLEOD.
 Paymaster's Clerk, JAMES MCGREGOR.

CADET-MIDSHIPMEN.

First-class (38.)

Barnard, L. H.	Garrett, L. M.	Kellogg, F. W.	Robinson, H. J.
Bell, J. A.	Garrett, L. O.	Lopez, R. F.	Schwerin, R. P.
Blish, J. B.	Gibbons, J. H.	Marsh, C. C.	Scars, W. J.
Brown, G. W.	Gibson, J.	Menefee, D. P.	Sloan, R. S.
Cahoon, J. B.	Gill, W. A.	Miner, R. H.	Snowden, T.
Chase, H. S.	Graham, W. A.	Moore, J. M.	Thom, W. A.
Clements, A. B.	Harlow, C. H.	Mudd, J. A.	Tillman, E. H.
Cunningham, A. C.	Hayden, E. E.	Read, M. L.	Welsh, G. S.
Dougherty, J. A.	Hood, J.	Ripley, C. S.	Wike, H.
Drayton, P. L.	Jungen, C. W.		

Third-class (72.)

Andrews, H. B.	Cockle, R. R.	Eldredge, H.	Harrison, E. H.
Babeock, W. F.	Cohen, H. R.	Emmett, W. L.	Hill, C. H.
Ballentine, H. L.	Colwell, J. H.	Flournoy, W. F.	Hoogewerff, J.
Barnett, G.	Craven, M.	Forl, W. G.	Hanicke, F. H.
Blow, G. P.	Craig, B. H.	Forslew, R. P.	Karmany, L.
Buck, G. M.	Crenshaw, J. D.	Foster, E. E.	Kase, S. M.
Bunts, F. E.	Dashiell, R. B.	George, C. P.	Kimball, J. A.
Capehart, E. E.	Donnelly, M. J.	Haines, H. C.	Lauchheimer, C.
Carroll, E.	Doyen, C. A.	Hains, R. P.	Lindsey, J. H.
Clark, G.	Dresser, J. W.	Harmon, E. M.	Linnard, J. B.

A. S.	Parsons, A. C.	Rodgers, G. G.	Weeks, J. W.
in, I.	Pierce, B. G.	Schock, J. L.	Weller, O. E.
y, J. E.	Porter, J. P.	Serata, T.	White, H. K.
rs, T. H.	Printup, D. L.	Smies, F. W.	Wilkes, G.
P. J.	Rees, J. L.	Stayton, W. H.	Williamson, S. H.
D.	Rider, F. C.	Stewart, C. W.	Wilson, A. B.
t, A. C.	Robinson, W. M.	Sutton, F. E.	Woodward, J. J.
F.	Russell, W. W.	Uriu, S.	Wright, S. H.

Constellation sailed from Annapolis Roads July 29, for New Bedford, Mass., August 3; left New Bedford, August 7, for Oak Bluffs, arriving the same day; Bluffs, August 9, for New Bedford, arriving the same day; left New Bedford, 13, for Newport, arriving August 14; left Newport, August 19, for Buzzard's exercised in Buzzard's Bay until September 3; then sailed for Annapolis, arriving 9, off the bar; exercised in Chesapeake Bay until September 23. From e until September 28 the cadets were engaged in rigging the United States -war Dale.

UNITED STATES PRACTICE-SHIP MAYFLOWER.

enant-Commander A. D. Brown, *Commanding*.

enant J. C. Soley.

1 Assistant Engineer C. H. Greenleaf.

1 Assistant Engineer R. Crawford.

ant Surgeon J. A. Tanner, jr.

CADET-ENGINEERS.

First class (21).

E. O'C.	Bowers, F. C.	Elseffer, H. S.	Norton, H. P.
J. W.	Bryan, B. C.	Isbester, R. T.	Pickrell, J. M.
I. H.	Carr, C. A.	Hunt, A. M.	Salisbury, G. R.
, F. M.	Carter, T. F.	McFarland, W. M.	Scribner, E. H.
on, M.	Crygier, J. U.	Lubbe, C. B.	Talcott, C. G.
F. T.			

Second class (1).

, W. D.

Third class (27).

n, M. A.	Dowst, F. B.	Moritz, A.	Smith, W. S., (late
S.	Eckel, H.	Nicholls, A.	fourth class.)
R. J.	Gartley, W. H.	Parsons, J. B.	Stewart, R.
. R.	Kaemmerling, G.	Perkins, L. B.	Webster, W. T.
i, L.	McAlpine, K.	Redgrave, D. W. C.	White, W. W.
I. E.	McAllister, A.	Sampson, B. C.	Whitham, J. M.
. B.	McCreary, H. R.	Shallenberger, O. B.	Whittle, L. F.

Mayflower left Annapolis June 24, and proceeded on her cruise, touching at Va.; New Castle, Wilmington, and Edgemoor, Del.; Chester, League Island rd, and Philadelphia, Pa.; New York, New London, Conn.; Boston, Oak Bluffs, r Bedford, Mass.; returning, touched at Newport Torpedo Station, Bristol, and nce, R. I.; New London, Conn.; Cold Spring, Newburgh, West Point, and New vy-yard, N. Y., and Washington, D. C.; sailed thence for the Naval Academy, he arrived September 28.

3 N A

Table of coefficients to be applied to the final averages in each branch in preparing the *senior* rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Coefficients.				Graduating maximum for
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship.....	Seamanship			11	13	
	Naval Construction				8	
Ordnance and Gunnery	Naval Tactics			12		
	Ordnance Instructions and					
	Infantry Tactics			5		
Mathematics.....	Ordnance and Armor.....				11	
	Algebra and Geometry	9				
Steam-Engineering	Trigonometry, Analytical Geometry, and Descriptive Geometry.....		18			
	Marine Engines				12	
Astronomy, Navigation, and Surveying	General Astronomy			6		
	Navigation and Surveying.....				16	
Physics and Chemistry.....	Physics and Chemistry.....		8			
	Electricity			6		
Mechanics and Applied Mathematics.....	Light and Heat.....				9	
	Mechanics and Applied Mathematics.....			14		
	Naval Architecture				*12	
English Studies, History, and Law.....	English and History.....	6				
	History and Rhetoric.....		6			
	Composition.....			5		
Modern Languages	Public Law.....				3	
	French	2	4	4		
Drawing.....	Spanish			3	2	
	Line-Drawing and Topography.....	2				
	Sketching		2			
Maximum for each year, exclusive of electives		76	152	228	304	
Deduction for each demerit		.004	.007	.01	.02	

* Elective.

Table of coefficients to be applied to the final averages in each branch, &c.—Continued.

CADET-ENGINEERS.

Department.	Subject.	Coefficients.				Graduating maximum for required studies.
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship	Naval Construction				4	16
Mathematics	Algebra and Geometry	9				108
	Trigonometry, Analytical Geometry, and Descriptive Geometry .....	.....	18	.....	.....	
Steam-Engineering	Mechanical Drawing	2	2			236
	Fabrication of Machinery .....	.....	.....	.....	.....	
	Designing of Machinery .....	.....	.....	19	36	
Astronomy, Navigation, and Surveying	Marine Engines					24
	General Astronomy .....	.....	.....	6	.....	
Physics and Chemistry	Physics and Chemistry		8			116
	Electricity .....	.....	.....	6	.....	
	Light and Heat .....	.....	.....	.....	8	
Mechanics and Applied Mathematics	Physical Measurements				7	116
	Mechanics and Applied Mathematics .....	.....	.....	14	.....	
	Mechanics .....	.....	.....	.....	11	
English Studies, History, and Law	Naval Architecture				4	81
	English and History	6	.....	.....	.....	
	History and Rhetoric .....	.....	6	.....	.....	
Modern Languages	Composition			5		64
	Public Law .....	.....	.....	.....	3	
	French	2	4	4	.....	
	Spanish			3	3	
Maximum for each year, exclusive of electives		76	152	228	304	760
Deduction for each demerit		.004	.007	.01	.03	

THE UNIVERSITY OF MICHIGAN LIBRARIES
SERIALS SECTION 1A LIBRARY
ANN ARBOR, MICHIGAN 48106-1000

MERIT-ROLLS FOR 1877-78.

it-rolls, made out yearly for each class, show the proficiency of the Cadets in each branch of study. The numbers given in the preceding table, showing the relative value of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the class for the year.

In the case of Cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course the amount by which the final mark in the elective course exceeds 2.50.

On the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

Cadets who attain 85 per cent. of the multiple in any year shall be distinguished and their names affixed to their names on the merit-rolls."—(Regulations U. S. Naval Academy, 150.)

Cadets whose names are marked thus (†) were found deficient, but were allowed to remain in their classes on condition of passing at a re-examination.

Cadets marked thus (‡) were found deficient, and turned back, to recommence the study of their respective classes.

Cadets marked thus (§) were found deficient, and recommended to be dropped.

Blank spaces denote absence from examination.

CADET-MIDSHIPMEN.

Merit-roll of first class (36 members), annual examination, June, 1878, and general merit-roll for four years.

Order of general merit.	Name.	Seamanship.					Naval construction.					Gunnery.					Marine engines, boilers, &c.					Astronomy and navigation.					Heat and light.					International law.					Spanish.					Conduct.					Aggregate for fourth year.					Aggregate for third year.					Aggregate for second year.					Aggregate for first year.					General aggregate for four years.				
		45	32	56	45	64	32	12	12	12	304	225	152	76	760																																																								
1	John H. Fillmore	43.20	29.52	50.82	43.92	57.92	29.76	10.53	9.18	1.53	273.32	207.36	143.31	71.43	695.42																																																								
2	Thomas S. Rodgers	39.48	28.08	49.28	42.00	53.20	28.72	10.86	11.10	1.52	267.19	204.06	132.60	70.51	674.96																																																								
3	John G. Quinby	42.00	28.40	49.28	42.96	56.96	30.56	10.26	8.88	3.24	266.06	198.97	132.80	68.70	666.53																																																								
4	Charles S. McCain	41.52	27.76	51.52	42.96	53.20	28.56	10.50	10.14	2.58	260.58	199.48	124.11	61.68	654.85																																																								
5	James H. Glennon	33.96	27.52	46.06	40.44	57.28	28.72	10.17	10.50	1.86	252.70	190.02	134.90	70.01	647.87																																																								
6	Harry S. Knapp	37.68	26.16	48.72	40.32	54.08	26.96	10.68	9.87	3.75	250.72	184.41	124.87	70.27	630.27																																																								
7	Frank J. Sprague	38.76	29.68	49.14	42.84	56.16	29.04	10.58	8.61	3.96	260.35	182.44	122.08	63.94	628.81																																																								
8	Roy C. Smith	37.44	26.64	46.48	38.40	53.28	24.88	9.57	8.94	1.20	244.43	182.86	122.67	62.63	613.59																																																								
9	William L. Rodgers	37.56	25.84	49.00	39.48	58.88	27.52	10.02	8.91	2.67	254.54	180.17	110.08	55.84	609.63																																																								
10	Albert N. Wood	43.82	29.28	48.40	38.28	54.40	26.96	9.81	9.03	1.59	257.93	181.55	111.45	56.21	609.14																																																								
11	Harry M. P. Huse	34.56	25.04	47.46	38.28	51.36	26.16	10.53	10.95	2.40	241.88	180.21	121.62	59.60	602.87																																																								
12	George F. Ormsby	36.12	29.20	42.28	36.84	46.40	23.00	10.62	10.32	1.71	233.07	187.28	116.41	62.64	599.20																																																								
13	Charles N. Atwater	37.92	25.92	44.94	36.48	49.44	23.28	10.53	8.88	1.68	235.71	171.44	119.41	71.31	597.41																																																								
14	Edward Lloyd, Jr.	37.80	26.48	49.28	38.16	52.48	23.44	10.65	7.95	1.71	243.93	170.86	115.78	66.35	596.92																																																								
15	John H. L. Holcombe	37.68	27.84	48.86	36.72	48.00	20.00	10.50	8.19	0.63	237.16	174.77	116.34	67.94	595.45																																																								
16	Richard M. Hughes	35.40	26.00	45.08	36.96	54.24	28.72	10.41	10.38	3.42	243.77	169.46	115.21	68.94	595.38																																																								
17	Peyton B. Eddy	38.40	25.68	47.88	38.16	47.68	23.84	10.26	8.82	0.90	239.73	178.08	111.09	64.86	589.66																																																								
18	Robert K. Wright	40.08	26.80	46.80	38.76	48.16	22.56	9.36	9.30	2.49	245.06	164.00	103.47	61.34	580.91																																																								
19	Harry Kimmel	33.60	25.84	44.52	36.72	51.52	28.48	10.35	8.46	2.22	236.47	164.00	103.47	61.34	580.91																																																								
20	Spencer F. B. Biddle	39.30	24.00	44.52	36.72	51.52	28.48	10.35	8.46	2.22	236.47	164.00	103.47	61.34	580.91																																																								
21	Thomas W. Ryan	35.28	24.88	46.36	35.52	46.08	21.96	8.76	7.05	2.81	210.08	160.17	106.36	67.57	554.09																																																								
22	John E. McDonnell	36.24	24.56	46.34	37.50	51.84	24.94	9.09	9.72	3.31	237.28	168.83	105.60	67.14	552.63																																																								
23	William C. Canfield	34.62	23.60	47.82	36.12	44.32	21.92	8.70	9.60	1.60	236.69	168.40	103.40	57.65	530.65																																																								
24	George B. Canfield	36.72	27.60	47.36	37.44	43.92	22.08	9.96	8.52	2.84	231.05	161.09	107.11	57.41	526.65																																																								
25	William P. White	37.56	24.00	44.00	34.00	47.52	21.52	8.25	8.58	2.54	226.53	155.93	104.53	57.41	526.65																																																								
26	George B. Clark	37.16	27.20	43.12	32.64	45.84	20.72	8.54	8.13	2.26	226.63	155.93	104.53	57.41	526.65																																																								
27	George B. Clark	37.16	27.20	43.12	32.64	45.84	20.72	8.54	8.13	2.26	226.63	155.93	104.53	57.41	526.65																																																								
28	John E. Canfield	35.76	24.00	44.00	34.00	47.52	21.52	8.25	8.58	2.54	226.53	155.93	104.53	57.41	526.65																																																								

30	Allen G. Rogers	36.60	34.80	42.28	36.00	46.40	22.88	8.52	8.19	2.61	223.66	154.03	194.54	53.88	537.51
31	John J. Knapp	36.60	36.56	46.62	35.16	40.44	23.36	9.27	8.28	3.60	231.60	154.33	98.23	48.30	532.46
32	Wilson L. Todd	32.64	53.04	41.16	35.72	51.20	21.04	9.60	7.89	2.61	217.08	150.56	105.61	56.52	530.37
33	Horatio H. Hooker	36.72	21.76	39.76	35.52	44.80	22.88	9.12	8.07	4.02	214.61	153.56	163.63	54.99	526.79
34	James H. Hetherington	36.24	24.08	45.22	34.08	43.68	21.04	9.12	8.37	3.57	218.26	146.40	162.80	55.94	523.40
35	Baino C. Dent	32.76	24.32	41.72	33.84	45.60	20.96	8.04	8.16	3.66	211.74	153.51	90.54	57.53	522.32
36	Augustus C. Almy	36.12	23.60	39.76	37.32	45.76	22.80	8.40	8.37	3.84	218.29	149.99	100.22	53.18	520.40
		31.44	22.56	38.36	33.96	42.72	20.08	8.22	7.95	3.12	202.17	153.88	105.45	53.23	514.73

CADET-MIDSHIPMEN.

Merit-roll of second class (42 members), annual examination, June, 1878.

Order of annual merit.	Name.	Seamanship.	Naval tactics.	Ordnance instructions.	Infantry tactics.	Astronomy.	Electricity.	Calculus and mechanics.	English composition.	French.	Spanish.	Conduct.	Aggregate.
		48	8	12	8	24	24	56	20	16	12		228
1	Maxima	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	R. H. Miner	40.92	7.42	10.35	7.20	21.54	21.48	54.60	16.95	14.28	10.74	0.77	204.71
3	E. E. Hayden	38.16	7.50	9.96	6.04	20.82	20.82	54.04	18.90	14.32	11.49	1.05	201.00
4	A. B. Clements	36.72	7.54	9.42	7.02	21.30	22.32	57.26	17.90	12.44	9.54	1.52	199.94
5	J. Hood	39.60	7.54	9.75	6.14	21.30	21.84	56.56	16.45	12.68	9.69	2.14	199.41
6	H. S. Chase	37.44	7.04	9.75	6.82	20.40	21.72	48.86	15.55	13.20	10.47	2.81	188.44
7	J. McC. Moore	41.76	7.60	10.14	6.64	19.74	19.74	40.74	18.70	13.40	9.57	2.33	185.70
8	L. M. Garrett	38.76	7.60	9.84	6.58	18.60	21.00	43.54	15.05	14.64	10.95	1.12	185.44
9	J. B. Bishop	37.20	7.72	9.21	6.50	18.24	22.38	48.44	14.20	13.44	9.60	1.60	185.33
10	C. C. Marsh	42.48	7.68	10.14	7.10	19.80	18.42	42.28	14.20	13.52	10.20	2.21	183.61
11	H. Wake	33.12	6.62	8.13	6.10	19.56	17.22	53.90	15.20	11.92	8.10	2.14	177.73
12	C. W. Jungen	37.92	7.14	9.90	6.84	17.53	16.86	45.64	14.60	12.60	9.51	1.42	177.26
13	R. S. Sloan	41.04	6.92	10.20	7.04	18.18	17.64	41.86	14.45	11.08	8.58	1.66	175.33
14	C. H. Harlow	41.52	7.08	9.87	6.94	17.58	18.00	38.22	13.80	11.72	9.06	2.37	172.66
15	R. P. Scherwin	39.48	6.70	9.90	6.94	16.44	16.92	39.90	17.40	12.72	8.46	1.69	168.44
16	C. S. Ripley	38.28	7.26	9.42	6.10	17.70	16.14	37.10	14.10	12.72	10.20	1.35	167.73
17	D. P. Menefee	41.16	7.78	8.46	6.46	17.04	17.34	37.10	13.35	11.36	9.48	2.03	167.50
18	L. O. Garrett	35.88	7.26	8.23	5.78	18.30	18.42	39.34	15.65	12.04	9.18	2.37	167.16
19	W. A. Gill	38.76	7.38	9.66	6.36	16.74	16.74	37.38	14.80	10.96	8.55	1.31	166.02
20	J. R. Calhoun	33.36	6.82	8.79	6.30	16.44	16.32	39.62	15.25	12.60	8.88	1.69	162.69
21	V. J. Sears	35.40	6.48	8.75	7.18	16.50	15.30	39.40	14.85	11.92	9.24	0.86	162.22
22	T. Snowden	34.80	7.26	8.73	6.38	18.24	16.14	38.64	13.20	10.56	8.46	1.10	161.31
23	J. Gibson	36.84	7.46	9.54	7.26	16.02	13.94	35.70	14.30	10.84	8.52	0.61	161.11
24	A. C. Cunningham	34.92	6.34	8.82	5.86	16.14	13.94	39.02	13.80	10.40	8.01	2.12	159.33
25	E. H. Tillman	33.96	6.72	9.21	6.08	13.90	13.90	39.08	18.00	11.28	9.24	2.51	159.22
26	J. H. Gibbons	34.20	6.74	8.82	5.66	16.02	13.64	37.24	14.60	11.96	8.24	2.48	158.84
27	R. L. Dwyer	32.40	6.10	8.13	5.13	14.92	13.48	37.22	14.20	11.60	8.62	1.40	158.02
28	H. W. Lopez	32.40	6.90	8.13	5.13	14.92	13.48	37.22	14.20	11.60	8.62	1.51	157.68
29	A. A. Thoms	33.84	6.66	8.82	6.32	15.78	13.30	35.68	15.80	12.00	8.46	1.69	157.13

30	G. W. Brown	34.44	0.02	9.09	5.88	16.44	10.32	36.26	13.10	11.36	8.55	1.73	156.63
31	H. J. Robinson	33.00	6.60	8.25	5.72	16.38	15.00	36.54	14.25	12.28	10.23	2.43	155.82
32	J. A. Dougherty	33.12	7.00	8.37	6.02	15.24	15.78	37.38	14.05	10.52	8.64	6.90	155.13
33	J. A. Mudd	35.04	6.08	9.57	5.96	15.60	15.24	35.70	14.55	10.80	7.80	2.42	155.08
34	J. A. Bell	32.04	7.18	8.70	5.70	15.48	16.80	37.10	12.70	10.56	8.04	1.85	152.57
35	G. S. Walsh	31.80	6.14	8.85	6.08	15.64	15.42	35.98	12.90	10.88	8.19	2.60	150.58
36	M. C. Gorges	34.08	6.74	7.77	6.10	15.69	11.58	36.40	14.95	11.32	8.70	2.50	152.01
37	M. L. Road	33.00	6.32	8.40	6.18	15.54	14.40	35.28	13.75	11.44	8.37	1.57	152.01
38	L. H. Barnard	34.80	6.98	8.58	5.98	15.50	14.40	35.42	13.50	11.60	8.13	2.53	151.93
39	W. W. Buchanan	35.52	6.80	9.00	6.50	14.58	15.00	39.08	13.25	10.68	8.16	1.05	148.18
40	R. O. Bidler	32.40	6.02	7.83	5.72	15.00	13.44	36.12	13.55	11.12	8.28	2.25	147.80
41	W. A. Graham	32.52	6.12	8.73	5.86	14.98	12.48	35.00	14.45	10.72	7.80	2.36	145.55
42	H. L. Sturdivant	36.46	5.56	0	5.24	16.02	0	36.54	12.45	10.20	0	0	.....

CADET-MIDSHIPMEN.

Merit-roll of third class (69 members), annual examination, June, 1878.

Order of annual merit.	Name.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.	Aggregate.
	Maxima	72	32	24	16	8	152
*1	P. R. Alger	74.16	27.84	21.36	14.24	6.72	142.88
*2	H. G. Dresel	66.24	29.20	21.36	14.60	7.76	137.84
*3	L. S. Norton	66.78	26.48	20.52	12.00	7.34	131.86
*4	J. B. Bernadou	63.18	25.28	20.22	14.12	7.78	129.46
5	W. H. Wolfersberger	63.54	24.80	20.22	12.24	7.20	127.34
6	A. A. Ackerman	60.30	28.00	19.26	11.92	7.14	125.98
7	P. W. Hourigan	61.02	24.56	21.84	12.24	6.90	124.68
8	H. Phelps	61.20	24.16	18.12	12.88	6.14	121.16
9	E. Wilkinson	56.16	27.36	18.48	13.36	6.94	120.77
10	G. E. West	60.48	24.96	17.16	12.52	5.86	120.25
11	A. R. Howze	60.30	22.32	16.80	14.16	6.50	119.48
12	P. D. Haskell	57.24	24.48	18.72	12.96	6.16	119.03
13	G. L. Dillman	59.94	22.80	17.04	12.60	7.30	118.71
14	J. B. Murray	57.78	23.76	18.12	13.84	6.20	118.36
15	S. Morgan	56.70	24.08	18.48	11.40	6.68	116.84
16	A. P. Niblack	52.38	24.32	20.76	12.32	6.90	116.27
17	W. C. P. Muir	55.44	21.84	18.84	13.36	6.42	114.92
18	T. A. Parke	54.36	22.32	18.36	13.56	5.72	113.32
19	J. S. Watters	52.56	22.24	18.84	12.52	7.34	112.21
20	J. H. Rohrbacker	51.12	23.44	20.58	12.52	5.14	112.09
21	J. M. Dickson	53.10	21.68	20.52	11.80	5.26	111.90
22	G. R. French	55.80	22.40	18.36	10.52	5.98	111.72
23	J. Beale	52.38	24.16	19.20	12.00	5.30	111.37
24	W. H. Emerson	50.94	24.88	17.10	11.84	7.20	111.61
25	J. C. Drake	56.70	21.60	16.62	10.48	6.38	110.66
26	L. Duncan	54.90	22.72	16.98	10.28	6.80	110.33
27	L. S. Van Duzer	50.22	24.96	18.54	10.04	7.30	110.13
28	W. E. Safford	45.90	25.68	17.82	13.68	7.36	109.68
29	F. R. Wall	51.66	21.60	18.72	12.40	5.98	109.42
30	A. N. Mayer	51.30	23.84	18.00	11.24	6.08	109.12
31	F. W. Bowden	48.42	21.44	20.76	12.36	5.38	107.62
32	W. J. Maxwell	52.20	21.20	17.46	11.72	5.82	107.49
33	F. R. Brainard	52.02	21.68	16.14	10.96	7.28	107.20
34	C. Cabaniss	47.34	21.44	19.38	13.32	5.64	106.86
35	M. K. Eyre	49.80	21.84	17.40	13.12	6.26	106.78
36	R. H. Scott	51.12	21.36	16.86	11.36	6.48	106.22
37	W. S. Sims	51.84	20.80	15.96	10.88	7.72	105.77
38	H. L. Fillebrown	50.40	20.56	16.86	11.12	7.30	105.42
39	F. J. Haeseler	50.58	20.88	16.08	10.96	7.36	105.23
40	E. Simpson, jr.	48.78	21.28	16.98	11.12	6.96	104.43
41	E. F. Lieper	46.62	22.16	16.74	11.56	7.60	104.24
42	F. A. Huntton	50.40	20.88	16.44	11.16	6.38	103.68
43	A. Cramer	50.76	20.00	16.08	10.64	7.20	103.60
44	L. J. Clark	49.68	21.76	16.62	10.32	6.12	103.29
45	T. Worthington	47.88	20.00	16.32	12.24	5.90	101.18
46	F. Swift	46.98	21.52	16.68	10.28	5.66	99.78
47	T. G. Dewey	45.90	20.00	16.50	11.32	7.04	99.27
48	W. G. Richardson	45.54	20.96	16.98	11.88	5.44	99.18
49	H. B. Ashmore	46.80	20.96	16.20	11.40	5.58	98.75
50	O. H. P. Belmont	44.10	21.60	15.96	13.40	5.80	98.36
51	E. W. Nash	46.44	20.24	16.14	10.00	5.18	96.32
52	J. F. Luby	45.72	20.08	16.14	10.48	5.26	96.03
	H. C. Poundstone (not examined)						
†	W. Truxton	51.84	21.68	19.08	9.68	7.68	108.68
†	H. M. Finley	45.54	22.16	17.34	13.00	5.68	101.81
†	J. S. Brown	47.52	19.92	16.08	10.88	5.30	97.65
†	E. Brinley	46.26	19.28	16.26	10.16	5.48	96.76
†	J. Gray	44.10	22.24	15.90	10.28	5.78	96.65
†	H. Rodman	44.46	20.80	15.60	11.00	5.26	95.33
†	L. H. Bullitt	46.08	17.84	16.20	10.28	5.42	95.12
†	L. Levissee	41.58	18.96	16.08	11.92	6.40	93.46
†	C. M. Perkins	41.58	18.00	16.14	11.20	6.48	91.76
†	C. H. Hill	43.38	20.64	15.66	10.92	5.00	91.25
†	P. B. Cooke	43.50	16.56	15.72	10.64	5.48	90.28
†	W. A. Gresham	41.94	15.68	15.60	10.56	7.24	90.21
†	Z. B. Vance	42.60	17.68	15.66	10.20	5.28	88.78
†	J. B. Bailey	41.58	17.04	16.20	10.72	5.22	88.22
†	E. R. Webster	35.82	13.28	13.86	10.00	5.40	78.25
†	G. E. Perry	28.28	9.90	13.62	8.76	5.48	66.18

CADET MIDSHIPMEN.

Merit-roll of fourth class (85 members), annual examination, June, 1878.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Aggregate.
		36	24	8	8		76
*1	John L. Schock.....	37.89	20.58	6.44	7.34	0.22	72.03
*2	John L. Rees.....	35.10	20.82	6.12	7.52	0.29	69.27
*3	Joseph H. Linnard.....	33.39	19.68	5.80	6.70	0.68	64.89
4	John A. Hoogewert.....	32.22	19.14	5.96	6.58	0.27	63.63
5	Tasaker Serata.....	34.11	17.82	5.64	5.84	0.11	63.30
6	Joseph J. Woodward.....	30.78	19.38	6.20	6.78	0.18	62.96
7	Frederick C. Rider.....	31.59	18.84	5.64	7.02	0.18	62.91
8	Henry C. Haines.....	31.32	18.54	5.98	7.38	0.66	62.56
9	Eugene Carroll.....	31.59	18.84	6.00	6.42	0.52	62.33
10	Houston Eldredge.....	30.33	19.14	6.38	6.62	0.46	62.01
11	Robert B. Dashiell.....	27.45	20.10	6.84	7.50	0.09	61.80
12	James E. Mahoney.....	27.72	21.00	6.54	6.74	0.37	61.63
13	Francis E. Sutton.....	28.71	19.98	7.10	5.56	0.34	61.01
14	Charles A. Doyen.....	28.98	18.54	6.44	7.28	0.64	60.60
15	Horace B. Andrews.....	29.25	18.42	6.48	6.50	0.19	60.46
16	Lincoln Karmay.....	27.09	19.50	6.20	6.00	0.20	59.19
17	Robert P. Forshaw.....	27.72	19.50	5.96	6.02	0.21	58.99
18	Alexander S. McCrea.....	26.91	19.26	6.64	7.14	0.96	58.99
19	Samuel Bryan.....	27.81	18.66	6.22	6.72	0.51	58.90
20	Sotokichi Urin.....	28.08	17.76	6.12	6.96	0.03	58.89
21	William F. Babcock.....	28.08	18.48	5.94	6.02	0.15	58.37
22	Felix H. Hunicke.....	25.92	18.00	6.84	7.70	0.19	58.27
23	Harry K. White.....	28.08	17.40	6.06	6.36	0.13	57.77
24	Henry L. Ballentine.....	27.45	19.20	6.24	5.36	0.49	57.76
25	William F. Flournoy.....	29.70	17.58	5.70	5.48	0.75	57.71
26	Byron G. Pierce.....	26.10	18.90	5.76	6.14	0.36	56.54
27	Henry B. Wilson.....	28.89	16.80	5.86	6.06	1.08	56.53
28	Charles H. Lauchheimer.....	26.10	18.18	6.88	5.64	0.44	56.36
29	Edward E. Capehart.....	25.74	18.06	6.28	5.66	0.69	56.25
30	Thomas H. Matthews.....	26.37	18.18	6.20	6.36	1.04	56.07
31	Arthur C. Parsons.....	27.72	16.80	5.86	6.24	0.62	56.00
32	Frederick W. Smies.....	26.10	16.68	5.80	7.34	0.25	55.67
33	Silas H. Wright.....	27.81	16.02	5.88	6.44	0.48	55.67
34	Felton Parker.....	26.01	16.50	7.30	6.98	1.20	55.59
35	Frank E. Buntz.....	26.64	17.16	5.76	6.12	0.15	55.53
36	Charles P. George.....	26.97	17.16	5.58	6.02	0.51	55.52
37	William H. Stayton.....	26.55	18.36	5.44	5.60	0.54	55.41
38	Guy G. Rodgers.....	27.89	17.10	5.96	5.28	0.93	55.30
39	Charles W. Stewart.....	26.10	17.22	5.64	6.24	0.41	54.79
40	Robert P. Hains.....	25.65	16.98	5.64	7.20	0.72	54.75
41	Rudolphus R. Cockle.....	26.10	17.64	5.94	6.18	1.12	54.74
42	William Le R. Emmett.....	25.83	16.98	5.40	7.26	1.16	54.51
43	William M. Robinson.....	25.74	17.40	5.34	6.20	0.79	53.95
44	Samuel H. Williamson.....	26.91	16.29	5.80	5.96	0.97	53.80
45	Max A. Orlopp.....	26.19	16.44	6.04	5.72	1.01	53.58
46	MacDonough Craven.....	25.11	16.38	5.64	7.30	1.07	53.36
47	Ben H. Craig.....	25.83	17.04	5.94	5.04	0.56	53.29
48	James W. Dresser.....	25.74	16.68	5.34	6.14	0.67	53.23
49	James H. Colwell.....	24.93	17.28	5.50	5.66	0.20	53.17
50	Franklin J. Moses.....	25.47	16.80	5.98	5.90	0.98	53.17
51	George P. Blow.....	25.29	16.20	5.32	6.90	0.73	52.98
52	Edward H. Harrison.....	24.84	16.92	5.12	6.10	0.21	52.77
53	Harry R. Cohen.....	23.49	16.80	5.70	6.52	0.08	52.43
54	James D. Crenshaw.....	24.84	15.96	5.92	5.84	0.13	52.43
55	Spencer M. Kane.....	23.13	16.92	5.70	6.46	0.22	51.99
56	Edward W. Foster.....	25.38	16.26	5.54	5.70	1.11	51.77
57	Ovington E. Weller.....	24.75	16.50	5.42	5.42	0.60	51.49
58	William W. Russell.....	23.49	17.22	7.02	4.82	1.20	51.35
59	David L. Printup.....	24.57	15.72	5.40	6.08	0.70	51.01
60	George Clark.....	24.30	15.66	5.32	6.04	0.38	50.94
61	John A. Kimball.....	23.58	16.08	5.44	6.18	0.44	50.84
62	George Barnett.....	25.22	16.98	5.16	5.58	0.17	50.77
63	John H. Lindsey.....	24.30	16.14	5.50	5.60	0.95	50.59
64	Eugene M. Harmon.....	22.86	17.40	5.46	5.72	0.95	50.49
65	Ira McJunkin.....	22.50	16.74	5.30	5.82	0.08	50.28
66	Michael J. Donnelly.....	22.95	16.44	5.42	5.74	0.65	49.90
67	John W. Weeks.....	22.95	16.14	5.02	5.94	0.23	49.82
68	William G. Ford.....	24.57	15.90	5.20	5.68	0.70	49.81
69	Guy M. Buck.....	22.68	15.36	5.32	5.18	0.19	48.55
70	Daniel Morgan.....	22.68	15.24	5.00	5.10	0.81	47.27

CADET-MIDSHIPMEN.

Merit-roll of fourth class (85 members), annual examination, June, 1878—Continued.

Order of annual merit.	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	36	24	8	8		76
†	James F. Will	23.85	16.56	5.76	6.36	0.20	52.33
†	John Pryor Porter	22.68	16.56	5.74	5.34	0.45	49.87
†	Abbott S. Cooke	22.59	15.36	5.40	6.90	0.88	49.27
†	Rutherford W. Forrest	20.43	14.88	5.66	5.16	1.30	44.83
†	Alexander C. Oliphant	21.96	15.78	5.66	6.00	0.38	49.02
†	Gilbert Wilkes	22.50	14.88	5.68	5.86	0.63	48.29
†	John T. Arnold	23.67	13.56	4.90	6.24	0.89	47.48
†	Llewelyn T. McKee	22.50	14.88	4.84	5.48	0.63	47.08
†	William L. Howard	20.25	15.54	5.34	5.74	0.25	46.62
†	Walter T. Paine	22.50	13.38	5.12	5.10	0.28	45.82
†	Sonoske Enouye	21.69	9.24		5.60	0.04	36.49
†	Edwin P. Deal	a	a	a	a	0.26	.....
†	Revere R. Gurley	24.03	16.26	a	5.64	1.05	.....
†	Albert L. Key	a	14.66	4.56	6.00	1.00	.....
†	John R. Miner	a	a	a	a	0.85	.....

CADET-MIDSHIPMEN.

Deficient sections of fourth class (25 members).

The following cadets, having been turned back at the semi-annual examination, have no relative position with the members of the fourth class:

† Bell, E. N.	† Hayden, T. W.	† Norton, O. D.
† Bennett, L. S.	† Hubbard, N. M.	† Poyer, J. M.
† Blake, R. B.	† Kent, G. E.	† Phythian, C. T.
† Conway, J. J.	† Kennett, Percy.	† Semple, L.
† Doyle, J. G.	† Lamkin, J. A.	† Slack, W. Y.
† Dudley, C. J.	† McGiffin, P. N.	† Smyth, J. W.
† Fletcher, W. B.	† McNutt, F. A.	† Stahle, F. H.
† Grambs, W. J.	† McWhorter, J. G.	† Wickes, J. L.
† Hoke, W. P.	† Morris, W. E.	

CADET-ENGINEERS.

Merit-roll of first-class (14 members), annual examination, June, 1873, and general merit-roll for four years.

Order of general merit.	Name.	Naval construction.	Steam-engineering.	Light and heat.	Physical measurements.	Mechanics.	Law.	Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
		32	144	32	28	44	12	12		304	228	152	67.91	754.91
1	Maxima													
2	Ira N. Hollis	29.60	133.92	28.32	26.95	41.58	10.44	9.78	2.40	278.19	209.94	142.93	73.86	704.92
3	Franklin J. Schell	29.60	128.16	30.24	25.20	41.58	10.92	10.35	0.84	275.21	207.34	138.85	70.40	691.89
4	Henry W. Spangler	29.92	132.48	29.52	25.41	42.35	10.26	9.09	3.21	275.79	203.81	136.94	67.06	683.60
5	Gould H. Bull	25.60	120.60	26.56	24.22	38.06	9.54	9.37	3.75	250.40	190.30	131.15	68.62	640.47
6	Robert S. Griffin	26.80	123.48	24.24	23.10	38.06	9.00	10.50	1.68	254.10	177.70	115.13	61.50	608.52
7	George W. McElroy	27.44	114.12	23.04	24.78	36.30	9.18	7.92	4.41	238.37	180.17	119.00	65.11	602.65
8	Mortimer E. Cooley	29.12	123.84	22.96	23.94	29.04	9.39	8.58	1.98	244.89	172.54	107.58	60.30	585.31
9	Frank W. Bartlett	25.52	114.48	21.44	24.50	28.93	9.39	8.67	3.57	220.36	165.43	116.38	67.63	578.80
10	Frederic C. Bieg	26.16	114.12	23.44	24.22	30.80	9.06	10.20	2.28	226.32	167.89	111.19	60.48	575.88
11	Howard Gage	23.88	109.44	23.92	21.58	29.59	9.18	8.37	3.51	221.87	159.63	112.24	66.67	560.41
12	Joseph R. Wilmer	24.88	107.64	23.84	21.50	31.13	9.51	9.06	2.97	224.65	160.72	109.55	61.74	556.66
13	John L. Gow	25.12	110.88	22.80	23.07	29.37	9.00	8.07	2.19	228.11	157.84	110.73	59.32	550.50
14	Charles L. Wight	24.24	114.12	24.48	23.60	30.47	8.94	8.10	3.90	220.25	154.88	104.02	61.35	530.50
15	George E. Burd	25.60	111.96	22.80	24.08	29.37	8.88	8.37	2.91	228.15	160.26	102.92	48.81	540.14

CADET-ENGINEERS.

Merit-roll of second class (23 members), annual examination, June, 1878.

Order of annual merit.	Name.	Steam-engineering.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Spanish.	Conduct.	Aggregate.
	Maxima	76	24	24	56	20	16	12		225
*1	W. M. McFarland ..	64.79	22.44	21.12	56.42	15.85	14.40	10.83	0.94	294.81
*2	Richard Gatewood ..	64.60	20.76	20.76	54.46	17.50	14.32	10.65	0.53	292.22
*3	F. T. Bowles	65.93	21.78	19.74	52.22	15.70	13.12	10.44	1.16	297.77
4	B. C. Bryan	61.37	20.16	19.32	51.38	15.65	12.44	9.93	0.70	286.55
5	C. A. Carr	62.13	19.56	20.16	43.96	17.55	13.20	10.41	0.88	286.55
6	C. B. Lubbe	64.79	18.54	19.50	44.52	15.75	12.56	8.49	1.26	282.69
7	H. K. Ivers	61.04	18.36	18.30	45.22	13.85	11.84	9.36	0.83	278.64
8	A. M. Hunt	63.08	19.08	16.08	40.18	15.80	13.80	10.89	1.74	277.77
9	E. O'C. Acker	58.90	19.56	19.74	38.22	16.20	11.56	9.03	0.52	272.49
10	J. W. Amman	63.84	17.46	16.44	36.26	16.40	12.40	9.09	2.09	269.80
11	H. P. Norton	64.98	16.08	16.74	37.24	13.55	10.56	8.19	0.96	268.28
12	R. T. Isbester	57.38	17.04	18.24	38.50	16.00	11.20	8.16	1.96	265.18
13	C. G. Talcott	58.33	17.94	16.74	38.08	13.80	11.60	9.21	1.61	264.69
14	H. S. Elseffer	61.56	17.94	15.12	35.70	15.00	11.92	8.46	1.81	263.59
15	F. M. Bennett	58.14	18.18	15.48	37.80	15.00	11.20	8.25	2.00	262.61
16	J. U. Crygier	59.28	16.38	15.36	36.12	15.95	12.00	8.52	1.81	262.49
17	E. H. Scribner	58.71	15.48	15.12	37.24	13.80	11.20	8.13	0.69	258.89
18	M. Bevington	57.00	15.66	15.36	36.82	15.55	10.72	8.16	1.69	258.18
19	P. C. Bowers	54.34	17.52	15.78	36.82	13.85	12.94	9.45	2.16	257.65
20	G. R. Sallsbury	55.48	16.50	15.36	36.12	13.80	11.48	9.00	1.67	256.65
21	J. H. Baker	58.33	15.36	15.18	35.84	13.55	11.16	8.37	2.35	255.44
22	T. F. Carter	55.48	15.36	15.78	35.28	14.45	11.04	7.80	0.83	254.28
23	J. M. Pickrell	54.34	15.84	15.60	35.14	13.75	11.00	8.25	2.33	253.39

CADET-ENGINEERS.

Merit-roll of third class (21 members), annual examination, June, 1878.

Order of annual merit.	Name.	Mathematics.	Physics and chemistry.	History, composition, and rhetoric.	French.	Mechanical drawing.	Conduct.	Aggregate.
	Maxima	72	32	24	16	8		132
*1	Albert W. Stahl	65.70	29.52	21.84	13.84	7.64	1.33	257.25
*2	William F. C. Hasson ..	70.02	27.44	19.62	14.20	7.36	1.39	257.19
*3	William F. Durand	69.30	28.24	18.72	12.68	7.42	0.80	253.36
4	Leo D. Miner	63.90	24.80	17.40	11.24	7.04	0.50	253.00
5	Arthur T. Woods	59.04	24.48	17.16	12.88	7.48	0.98	250.15
6	Joseph L. Wood	55.62	22.96	20.88	14.72	5.92	0.60	248.56
7	Winfield S. Sample	61.92	22.40	16.98	11.96	6.84	0.58	248.00
8	William H. Alderdice ..	55.26	25.28	19.56	11.40	7.40	1.71	247.28
9	Albert O. Young	52.38	23.12	17.88	12.20	6.70	0.60	247.05
10	Charles E. Manning	50.40	25.52	17.58	11.40	6.96	1.06	246.80
11	Thomas W. Kinkaid	48.24	25.60	18.00	11.48	5.78	0.35	246.20
12	Harry Hall	51.30	22.16	17.10	12.16	5.96	0.50	247.80
13	Albert E. Smith	51.12	22.00	17.70	10.60	7.14	1.18	247.20
14	Charles A. King	48.60	23.28	17.82	11.12	5.82	0.87	246.77
15	William D. Weaver	46.80	24.16	16.98	11.72	5.56	2.09	246.13
16	Clarence H. Mathews ..	40.26	22.00	16.80	11.28	5.90	1.13	241.11
17	John L. Worthington	45.00	20.32	16.02	12.92	5.38	0.51	240.15
18	Charles E. Belden	46.44	19.84	15.84	10.52	5.88	0.50	238.02
19	William S. Smith	46.20	20.00	15.60	10.08	5.94	0.69	237.59
20	Frederick M. Lillebridge ..	34.56	14.96	15.72	10.44	6.80	1.60	236.73
21	William Lang	a	a	a	a	6.36		

CADET-ENGINEERS.

Merit-roll of fourth class (29 members), annual examination, June, 1878.

Order of annual merit.	Name.	Mathematics.	Mechanical drawing.	History and composition.	French.	Conduct.	Aggregate.
		36	8	24	8		76
	Maxima.....						
1	Gustave Kaemmerling.....	31.86	6.78	17.70	6.10	0.37	62.07
2	Llewellyn F. Whittle.....	27.99	6.04	19.56	6.88	0.41	60.06
3	James E. Byrne.....	29.25	7.60	17.34	5.76	0.65	59.30
4	Solon Arnold.....	26.91	6.40	19.50	6.82	0.37	59.26
5	Robert Stewart, jr.....	27.27	5.96	19.56	6.48	0.32	58.95
6	Arthur Nichols.....	26.73	7.72	18.00	6.38	0.42	58.41
7	Oliver B. Shallenberger.....	27.90	7.36	16.98	5.82	0.28	57.78
8	Herman Eckel.....	25.74	6.58	18.90	6.86	0.38	57.70
9	Jay M. Whitham.....	27.99	6.34	17.58	5.46	0.21	57.16
10	William H. Gartley.....	26.37	6.74	17.82	5.52	0.90	55.55
11	Bias C. Sampson.....	27.63	5.74	16.92	5.64	0.42	55.51
12	Arthur R. Bush.....	26.64	7.18	16.20	5.70	0.62	55.10
13	Frank B. Dowst.....	25.11	6.16	17.34	6.58	0.39	54.80
14	Isaac B. Parsons.....	26.37	7.12	16.74	5.08	0.66	54.65
15	Martin A. Anderson.....	25.11	7.46	16.68	5.72	0.46	54.51
16	Kennett McAlpine.....	24.93	5.98	17.94	6.34	0.77	54.42
17	DeWitt C. Redgrave.....	25.47	6.40	16.02	6.14	0.41	53.62
18	William S. Smith.....	25.02	6.60	17.22	5.08	0.40	53.52
19	Lloyd Bankson.....	24.93	6.90	16.38	5.50	0.38	53.33
20	William T. Webster.....	24.84	6.98	16.74	5.38	0.81	53.13
21	Lyman B. Perkins.....	25.20	6.28	15.96	5.48	0.38	52.54
22	Robert J. Beach.....	24.03	7.02	16.44	5.54	1.00	52.03
23	Albert Moritz.....	24.03	6.06	15.18	5.92	0.55	50.64
24	William W. White.....	24.48	5.48	15.30	5.10	0.61	49.75
25	Harry R. McCreary.....	23.13	4.92	16.14	5.14	0.50	48.83
†	Andrew McAllister.....	22.23	6.02	16.62	5.20	0.62	49.45
+	Willis B. Day.....	22.32	5.80	15.96	5.32	0.49	48.91
+	Herbert P. Prevcar.....	21.15	5.90	16.56	5.70	0.41	48.90
+	Daniel D. Gladstone.....	a	5.62	a	a	1.09	.....

THE UNIVERSITY OF MICHIGAN LIBRARIES
1115 ZEEB

REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; ten appointed at large. According to the act of Congress approved June 17, 1878, "There shall not be at any time more in said Academy appointed at large than 10." As it will take some time before the number now at the Academy can be reduced, there will be no appointment at large for at least three years to come.

I. The nomination of candidates for admission from the District of Columbia and at large is made by the President. The nomination of a candidate from any Congressional district or Territory is made on the recommendation of the Member or Delegate in actual residents of his district or Territory.

II. Each year, as soon after the 5th of March as possible, Members and Delegates shall be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress. They will be filled by appointments from the districts in which the vacancies exist.

V. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 11th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the examination, will be examined on the 22d of September following; and should a candidate fail to report, or be found physically or mentally disqualified for admission, in June, the Member or Delegate from whose district he was nominated will be required to recommend another candidate, who shall be examined on the 22d of September following. When any of the dates assigned for examinations fall on Sunday, examination will take place on the following Monday.

A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the humiliation and disappointment consequent upon failure, by accepting nominations attempting to enter a service for which they are not fitted.

EXAMINATION.

I. Each candidate for appointment as Cadet-Midshipman must present to the Academic Board satisfactory testimonials of good moral character, and must certify *on oath* to his precise age, which must be over fourteen and less than eighteen years at the time of the examination. No candidate will be examined whose age does not fall within the prescribed limits.

II. Candidates must be physically sound, well formed, and of robust constitution; and will be required to pass a satisfactory examination before a medical board composed of

posed of the surgeon of the Naval Academy, and two other medical officers to be designated by the Secretary of the Navy.

VIII. Any one of the following conditions will be sufficient to cause the rejection of a candidate:

- Feeble constitution, inherited or acquired;
- Greatly-retarded development;
- Permanently-impaired general health;
- Decided cachexia, diathesis, or predisposition;
- All chronic diseases or results of injuries that would permanently impair efficiency,

viz:

- Weak or disordered intellect;
- Cutaneous and communicable diseases;
- Unnatural curvature of spine, torticollis, or other deformity;
- Permanent inefficiency of either of the extremities or articulations from any cause;
- Epilepsy or other convulsions within five years;
- Impaired vision, or chronic disease of the organs of vision;
- Great hardness of hearing or chronic disease of the ears;
- Chronic nasal catarrh, ozæna, polypi, or great enlargement of the tonsils;
- Impediment of speech to such an extent as to impair efficiency in the performance of duty;

Chronic diseases of heart or lungs, or decided indications of liability to cardiac or pulmonary affections;

- Hernia or retention of testes in inguinal cavity;
- Sarcocele, hydrocele, stricture, fistula, or hæmorrhoids;
- Large varicose veins of lower limbs, scrotum, or cord;
- Chronic ulcers.

Attention will also be paid to the stature of the candidate; and no one manifestly under size for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates who fail below the standard will receive a second and final examination in the subjects in which they fail. Deficiency in any one of the subjects at the second examination will be sufficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have the privilege of another examination for admission to the same class unless recommended by the Board of Examiners."—(*Rev. Stat.*, § 1515.)

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is required to express in figures any whole number, decimal, or mixed number; to write in words any given number; and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pounds; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and vice versa.

Fractions.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such pro-

cesses, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetics.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school arithmetics. It is essential that the candidate shall be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes, and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical political, or commercial importance (attention is specially called to the rivers and bodies of water on which cities are situated); the course of a vessel in making a voyage between well-known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as treated in the common-school text-books, embracing the following subjects: The divisions of letters and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for *comparing adjectives*; irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives, secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as the difference between *my* and *mine*, between *thou* and *you*, and the various uses of *it*; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs*; the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflection of *auxiliaries*; the essential peculiarities in the use of voice, mood, tense, number, and person; tense-endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs*; conjunctive adverbs; the use of *prepositions*, *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under syntax.

Parsing, according to the following model :

Noun : Class, gender, number, person, case.

Article : Definite or indefinite ; qualified noun.

Adjective : Class, compared or not compared ; comparison, if admitting it ; degree of comparison ; qualified noun.

Personal pronoun : Person, gender, number, case.

Relative pronoun : Person, gender, number, case, antecedent.

Interrogative pronoun : Gender, number, case.

Adjective pronoun (or pronominal adjective) : Class ; qualified word.

Verb : Class, form, principal parts, tense, mood, voice, person, number, subject.

Adverb : Class ; derivation and comparison, if derived and compared ; qualified word.

Preposition : Words between which the relation is shown by the preposition.

Interjection : The kind of emotion expressed.

Conjunction : Class ; words or sentences connected.

The construction of the word will be required in all cases.

READING.—Candidates will be examined in reading aloud English prose in a standard work ; for example, Bancroft's History of the United States.

WRITING AND SPELLING.—Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use.

An exercise containing eight or more mistakes in spelling will not be considered satisfactory, and will be sufficient of itself to cause the rejection of the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations will receive appointments as Cadet-Midshipmen, and become inmates of the Academy. Each cadet will be required to sign articles by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy), unless sooner discharged. The pay of a Cadet-Midshipman is \$500 a year, commencing at the date of his admission.

XIV. Cadets, immediately after their admission, will supply themselves with the following articles, viz :

One parade-suit	\$37 72	One hair mattress	\$8 25
One undress-suit	19 45	One straw mattress	1 33
One working-suit	2 56	One hair pillow	1 19
One overcoat	23 30	One pair blankets	3 97
One rubber-coat	5 28	Two bed-spreads	2 19
One parade-cap	3 87	Six sheets	4 08
One undress-cap	1 63	Four pillow-cases	1 00
* Two pairs high shoes	11 50	* One tooth-brush	25
One pair gymnastic slippers	92	* One hair-brush	30
* Eight white shirts	9 48	* One whisk	25
* Two night-shirts	2 10	* One coarse comb	30
* Four under-shirts	2 60	* One fine comb	37
Twelve linen collars	1 92	One mug	13
* Eight pairs socks	2 00	* One cake soap	19
* Four pairs drawers	2 64	One soap-dish	13
* Six handkerchiefs	1 62	One requisition-book	30
* Eight towels	2 00	One laundry-book	30
Two pairs drill-gloves	1 28	One pass-book	30
Two pairs Lisle-thread gloves	50	One stencil and ink ; 1 brush	41
* One pair suspenders	48	* One thread-and-needle case	31
One neck-tie	44	One rug	1 51
Two clothes-bags	48	One wash-basin and pitcher	1 12

Room-mates will procure for their common use—

One looking-glass (half-cost)	\$0 58	One broom (half-cost).....	\$0 14
One water-pail (half-cost)	48	One table-cover (half-cost).....	53
One slop-bucket (half-cost)	48		
Total			164 74

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home, but all other articles must conform to the regulations, and must, therefore, be supplied by the storekeeper.

X. Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of \$50, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, in the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of fifty dollars must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing.....	\$164 74
Deposit for books, &c	50 00

Total deposit required..... 214 74

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XV. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling expenses.

R. W. THOMPSON,
Secretary of the Navy.

EXAMINATION OF CANDIDATES FOR ADMISSION AS CADET-MID-SHIPMEN, JUNE, 1878.

ARITHMETIC.

JUNE, 1878.

1. Divide .00022406356 by .0743. Divide 224.06356 by .00746. Reduce .0028125 to a common fraction in its lowest terms. Divide 9.614 by .0000019, and $\frac{2\frac{1}{2}}{5\frac{1}{2}}$ by $\frac{1}{4}$ of .001 and multiply the sum of the quotients by .0005.

2. Simplify each of the expressions

$$2.5 + 1.25 - 2.125 \text{ and } \frac{1}{.01} - .4 \text{ of } .0005 + .002 \text{ of } .0125$$

$$\text{Multiply } \left\{ \frac{1}{1 + \frac{1}{1 + \frac{1}{2}}} + \frac{1}{1 + \frac{1}{3}} - \frac{13}{30} \right\} \text{ by } \left\{ \frac{1\frac{1}{2}}{1\frac{1}{2}} - \frac{2\frac{1}{2}}{4\frac{1}{2}} \right\},$$

and divide the result by $\left\{ \frac{27}{64} - \frac{20}{63} \right\}$.

3. Express 5 days, 14 hours, 49 minutes, 12 seconds as a decimal of 30 days. What decimal part of a Troy pound is 4 dwts., 12 grains? Subtract 9.85 inches from .375 yards, and give the result in feet. Reduce $\frac{\text{£}19 \text{ } 16s. \text{ } 7\frac{1}{2}d.}{\text{£}20 \text{ } 10s. \text{ } 8\frac{1}{2}d.}$ to its lowest terms.

4. Find the interest on \$750 for two years, 3 months, at 7 per cent. per annum. Find the interest on £200 10s. 10d. for 3 months, at 8 per cent. per annum. What was the premium on gold when a greenback dollar was worth only 75 cents? The silver dollar weighs 412½ grains; supposing silver to be worth \$1.05 per oz. Troy, what per cent. of profit does the government make on each silver dollar coined?

5. A man buys 27 sheep for \$144, and sells 12 of them at a loss of 3 per cent.; at what price per head must he sell the remainder in order to clear 2½ per cent. on the whole purchase? If 8 men can perform a piece of work in 12½ days, in what time will 9 men and 5 boys working together do the same work, if a boy can do $\frac{1}{2}$ of a man's work?

6. Find the square root of 3145.685 to four decimal places, and the cube root of 291 to three decimal places. What is the value of $\sqrt{3789954} \times \sqrt{3789954}$? Write the values of the following expressions (only one significant figure required in each case) $\sqrt{.049}$, $\sqrt{.0009}$, $\sqrt[3]{.0000027}$.

7. How many yards of carpet 2 feet 1 inch wide will it take to carpet the floor of a room 25 feet long and 20 feet wide? What is the width of a piece of canvas which is 7 feet $3\frac{3}{4}$ inches long, and covers 2 square yards 103½ square inches? The carpeting of a room twice as long as broad, at \$1 per square yard, costs \$24.50; and the painting of the walls, at 15 cents per square yard, costs \$10.50; what is the height of the room?

8. Find to seven decimal places the value of the series

$$\left\{ \frac{1}{3} + \frac{1}{3} \cdot \frac{1}{(3)^2} + \frac{1}{5} \cdot \frac{1}{(3)^3} + \frac{1}{7} \cdot \frac{1}{(3)^4} + \text{&c.} \right\}$$

ENGLISH BRANCHES.

JUNE 26, 1878.—Time allowed, three hours.

GRAMMAR.

1. Decline (or inflect) *city*, *which*, *sea*, *wharf*.

2. What adverb corresponds to the adjective *good*? *happy*? *true*? *wise*? *noble*?

3. Give the principal parts of *smite, rid, steal, drown, throw*.
4. Explain the use of the indicative mood, and of the tenses included under it.
5. What part of speech is *as* in each of the following sentences?
 1. *Do as I do.*
 2. *As we have finished, we will go.*
 3. *Let such as hear, take heed.*
6. Parse the words in italics in the following:

Thus ended the reign of terror, a period fraught with greater political teaching than any of equal duration which has existed since the beginning of the world.

SPELLING.

Peaceable,	Competition,	Besiege,	Victuals,
Height,	Comparative,	Participle,	Tongue,
Business,	Sagacity,	Jealous,	Officious,
Seizes,	Militia,	Legislate,	Jeopardy,
Vertical,	Battalion,	Vengeance,	Referred,
Coincidence,	Cemetery,	Tyrannical,	Syllable.

GEOGRAPHY.

1. Bound Kansas.
2. Where is Valparaiso? Pensacola? Aberdeen? Batavia? Lyons?
3. Where is the Gulf of Lyons? Bay of Bengal? Cattegat? Great Bear Lake? Tigris River?
4. Where are the Green Mountains? Blue Ridge? Black Forest? White Mountains? Sierra Nevada?
5. Make a *coasting voyage* from Savannah to Cayenne, naming in order the States or countries you pass and the waters you pass through.

RE-EXAMINATION.

ARITHMETIC.

JUNE, 1878.—Time allowed, five hours.

1. Divide 7006.652 by 12.34; .000144 by .012; and .014904 by $3\frac{1}{2}$. Find the sum of $\frac{11\frac{1}{2} - .35}{.05 - \frac{1}{2}}$ and $\frac{1}{1\frac{1}{2}} + 6.007$, and the difference between $\frac{1}{2}(1.35 - .72)$ and 5.004, and divide the sum by the difference.
2. If one mean of a proportion is $5\frac{1}{2}$ and the two extremes are $2\frac{1}{2}$ and $7\frac{1}{2}$, find the other mean. How many men would it employ for $5\frac{1}{2}$ days to cultivate a field of $2\frac{1}{2}$ acres, if each man completed 77 square yards in 9 hours, and the day consisted of 10 hours?
3. Divide 345 lbs. 9 oz. 16 dwts. 20 grs. by $13\frac{1}{2}$. Find a sum of money that shall be the same part of £14 7s. 9 $\frac{1}{2}$ d. that 4 oz. 7 dwts. 5 grs. is of 8 oz. 10 dwts. 15 grs.
4. After deducting a charge of $8\frac{1}{2}$ per cent. on a certain sum of money and $6\frac{1}{2}$ per cent. on the remainder, the result is \$1,385.10; find the original sum.
5. Find the cube root of 377.149515625, and the square root of $5017\frac{1}{4}$.
6. Divide 1 by 2, the quotient by 3, that quotient by 4, and so on, increasing the divisors by unity each time and carrying out the division to 8 decimal places, until a quotient is obtained which has no significant figure up to the eighth decimal place, then add all the quotients together.
7. If 3.1416 represents 180° , what does 1. represent? (Answer in degrees, minutes, and seconds.) Find the ratio between the rates of two locomotives, one of which travels $397\frac{1}{2}$ miles in $11\frac{1}{2}$ hours, the other $262\frac{1}{2}$ miles in $8\frac{1}{2}$ hours.
8. A can perform a certain piece of work in 12 hours. A and B together can do it in 5 hours, and C can do $\frac{1}{2}$ as much work in an hour as B can. A begins to work at 5

o'clock; at what time shall *B* and *C* join him, so that all working together they may complete the work at 12 o'clock? and if \$8.40 is paid for the whole work, how should it be divided between *A*, *B*, and *C*?

ENGLISH BRANCHES.

JUNE 28, 1878.—Time allowed, three hours.

GRAMMAR.

1. Decline (or inflect) *gulf*, *sky*, *journey*, *sheep*.
2. Give the principal parts of *mean*, *strive*, *sit*, *set*, *blow*.
3. Name the adverbs corresponding to *shy*, *able*, *cruel*, *worthy*, *bad*.
4. Name the three cases, and explain the different uses of each.
5. What part of speech is *that* in each of the following sentences:
 1. *That* book belongs to me.
 2. I know *that* you want him.
 3. The people *that* I knew once.
 4. The court of England, or *that* of France.
6. Parse the following: At every step which you take, you will now remember the sacrifice you made for your country.

SPELLING.

Imperative,	Sovereign,	Carcass,	Conscience,
Sagacity,	Sincerity,	Equivalent,	Preference,
Autumn,	Receive,	Scientific,	Virtuous,
Until,	Believe,	Precedence,	Vicious,
Privileges,	Tantalize,	Division,	Resurrection,
Auxiliary,	Guile,	League,	Campaign.

GEOGRAPHY.

1. Where is Stettin? Galveston? Monrovia? Singapore? Cherbourg?
2. Describe the following rivers, telling where they rise, in what direction they flow and into what water they empty: 1, Loire; 2, Irrawaddy; 3, Vistula; 4, Dnieper.
3. On what water is each of the following: 1, Charleston; 2, Geneva; 3, Calcutt
- 4, Lisbon; 5, Hamburg.
4. Name the chief peninsulas of Europe, and tell in each case the inclosing bodies water.
5. Where is Mount Chimborazo? Mount Hecla? the Cevennes Mountains? El Ridge? Pyrenees?

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

I. In pursuance of law, applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. The number of appointments which can be made is limited by law to twenty-five each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four years at the Naval Academy, and two additional years at sea. All cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer while at the Naval Academy is \$500 per annum.

V. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the first degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition, and geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude, and an elementary knowledge of the principles governing the action of the steam-engine. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

The other requisites and conditions are the same as those for the admission of Cadet-Midshipmen.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1878.

ARITHMETIC.

Time allowed, three hours.

1. At 10h. 33m. a. m., a ship was in latitude $37^{\circ} 51' N.$, longitude $55^{\circ} 37' W.$, and at 3h. 25m. p. m. she was in latitude $38^{\circ} 45' N.$, longitude $55^{\circ} 23' W.$; her rate in the interval being uniform, what was her latitude and longitude at noon of the same day? The results are required to the nearest second.

2. The silver dollar weighs $412\frac{1}{2}$ grains, $\frac{7}{8}$ of which is pure silver. At the English mint a mixture of 11 oz. 2 dwts. of silver with 18 dwts. of alloy is coined into 63 shillings. When English silver is worth 54d. per oz. in gold, and the pound sterling (gold) is worth \$4.86 in United States gold, what is the value in United States gold of the silver contained in the dollar? (The value of the alloy in English silver is not to be considered.)

3. How many gallons (231 cubic inches) will be contained in a tank whose dimensions are 20 feet 8 inches by 11 feet 10 inches by 8 feet $5\frac{1}{4}$ inches? If it costs \$3.75 to paper the walls of a room, what will it cost to paper the walls of another room, whose breadth, height, and length are each half as much again, the paper being half as wide again, and costing twice as much per linear yard?

4. The time of oscillation of a pendulum varies as the square root of its length, and the seconds pendulum is 39.1393 inches long; find the length of one which oscillates 80 times in a minute (4 decimal places). Find the cube root of 4920 to 5 decimal places.

5. When it is noon by the true time, a watch is slow $6\frac{1}{11}$ minutes, and loses at the rate of 12 minutes in exactly $20\frac{1}{2}$ hours of true time. What is the true time when the hands are together between 3 and 4 o'clock of the same day?

ALGEBRA.

Time allowed, three hours.

Simplify the expressions—

$$6 \left\{ \frac{x+y}{2} - \frac{x-2y}{3} \right\} - 36 \left[\frac{x}{18} - \left\{ \frac{3x-4y}{9} - \frac{1}{3} \left(\frac{x-5x+2y}{4} \right) \right\} \right],$$

and

$$\frac{\frac{a^2}{a^2+b^2}-b}{a+b-b} + \frac{\frac{b^2}{a^2+b^2}-a}{a+b-a}$$

2. Simplify $(x^a)^{b-c} \cdot (x^b)^{c-a} \cdot (x^c)^{a-b}$. Find the simplest factors of x^3+x^2 , x^2+5x+6 , $6x^2+5x-6$, $x^4-3a^2x^2+a^4$, and $x^2-\left(\frac{a}{b}-\frac{b}{a}\right)x-1$.

3. Find the greatest common division of $qnp^3+3np^2q^2-2npq^3-2nq^4$, $3m^2q^2-4mp^4-mp^3q+3mpq^3$. Divide 1 by $1-\frac{x}{2}+\frac{x^2}{4}$ as far as the term involving x^4 . Find the coefficient of x^4 in the product of

$$1-\frac{x}{2}+\frac{x^2}{4}-\frac{x^3}{8}+\frac{x^4}{16} \text{ by } 1+\frac{x}{2}+\frac{x^2}{4}+\frac{x^3}{8}+\frac{x^4}{16}.$$

4. Prove that if 16 be added to the continued product of any four consecutive odd integers, the result will be a perfect square. Solve the equation

$$\frac{x+2}{3} - \frac{38-2x}{6} + \frac{x-8}{8} - \frac{4}{9}(x-7) = 2.$$

5. Solve the equations—

$$\left. \begin{aligned} \frac{3}{4}x - \frac{2}{5}y &= 6 \\ \frac{x}{2} + \frac{2y}{3} &= 18 \end{aligned} \right\} \text{ and } \begin{aligned} \frac{(x-a)^2}{(x-b)^2} &= \frac{x-2a+b}{x-2b+a} \end{aligned}$$

GEOMETRY.

Time allowed, two hours and a half.

1. Define *right angle*, and *perpendicular*, *parallelogram*, *rhombus*, *rhomboid*, *trapezoid*. Prove that if from any point within a triangle two straight lines be drawn to the extremities of either side, their sum will be less than that of the remaining two sides of the triangle.

2. Prove that an inscribed angle is measured by one-half its intercepted arc. What is the measure of an angle formed by a chord and a tangent? What is the measure of an angle formed by two secants intersecting without the circumference? Prove the latter.

3. Prove that the line which bisects either angle of a triangle divides the opposite side into segments proportional to the adjacent sides. The hypotenuse of a right triangle is a and one of the adjacent angles is 30° , a line is drawn bisecting the angle; find the segments into which it divides the opposite side.

4. What is meant by extreme and mean ratio? Prove that if the radius of a circle be divided in extreme and mean ratio, the greater segment will be equal to one side of the regular inscribed decagon. Denoting the radius by a , find an expression for the side of the decagon.

5. Two tangents AB and AC are drawn to a circle. D is any point on the circumference outside of the triangle ABC . Prove that the sum of the angles ABD and ACD is constant, and show what this constant sum is. Show how the result is modified when D is taken within the triangle ABC .

NATURAL PHILOSOPHY.

Time allowed, three hours.

1. Define the terms *specific gravity*, *density*, *centre of gravity*. Determine the weight of a cubic yard of a homogeneous body whose specific gravity is 1.2, the weight of a cubic foot of water being 1,000 ounces.

2. How would you determine the specific gravity of a piece of cork? Find the centre of gravity of a triangle.

3. How would you find practically the centre of gravity of an irregularly shaped piece of flat boiler-iron of uniform thickness? The top of the leaning tower of Pisa overhangs its base by 12 feet. Why does it not fall?

4. Explain clearly what you understand by the weight of a body. If a body be weighed with the *same spring balance* at this place and at the equator, will its weight, as thus ascertained, be the same in both instances? Give the reasons.

5. A vessel whose sides are vertical and base horizontal contains 3 quarts of water, the depth being 10 inches; when a piece of copper whose specific gravity is 8.9 is immersed, the surface of the fluid rises to the height of $11\frac{1}{2}$ inches. Find the weight of the copper, a pint of water weighing one pound.

6. Two heavy spheres whose diameters are 4 and 3 inches respectively are suspended at the opposite ends of a straight rod 7 feet 7 inches in length. Find that point on the rod at which a support must be placed in order that the system may be sustained with the rod in a horizontal position.

7. Find the reading of the centigrade thermometer which corresponds to 122° Fahrenheit's scale. If the difference of readings of a thermometer which is graduated according to both Fahrenheit's and the centigrade scales be 40°, find the temperature by each scale.

8. Find the height to which a common pump can raise a liquid whose specific gravity is 1.7 when the barometer stands at 29 inches, the specific gravity of mercury being 13.6.

ENGLISH BRANCHES.

SEPTEMBER, 1878.—Time allowed, three hours.

ENGLISH GRAMMAR.

1. Decline (or inflect) *chimney, commander-in-chief, cargo, wife*.
2. What is a transitive verb? a participle? an ordinal? a personal pronoun? an impersonal verb?
3. Give the principal parts of *hold, ring, stick, lay, lie, set, sit*.
4. Compare *many, little, cleanly, elder, next*, without using adverbs.
5. How does the potential mood represent a fact? What tenses has this mood? Give the first person singular of the verb *to lay* in each of the tenses of this mood.
6. Parse the words in italics. The effect of the *explosion* had been *so violent*, that the tower *was cracked for more than forty feet above* the chamber of the mine; *but this was only a crack*.

GEOGRAPHY.

1. What countries border on the Adriatic? the Baltic?
2. Fix the position of the following islands, and state to what nation each belongs: 1. Malta; 2. Iceland; 3. Corsica; 4. St. Helena; 5. Jamaica.
3. Name in order the states of South America bordering on the sea-coast, and give the capital of each.
4. Where is Cape St. Roque? Cape Clear? Cape St. Vincent? Cape Comorin?
5. Tell the source, direction, and mouth of the Rhine, the Rhone, the Danube, and the Ganges.

SPELLING.

Deceitful,	Supremacy,	Fiend,	Fatigue,
Military,	Siege,	Supersede,	Inseparable,
Jealousy,	Scissors,	Absence,	Column,
Judgment,	Guardian,	Business,	Perceive,
Definite,	Genius,	Parallel,	Prejudice,
Auxiliary,	Courageous,	Recommend,	Stratagem.

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.*—Description of all kinds of rope, and its practical manipulation for all purposes on shipboard; measuring for and fitting standing and running rigging; masting, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seamaanship, with lectures and illustrations from models.

NAVAL CONSTRUCTION.

Text-books.—Thearle's Naval Architecture and Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and manœuvring of a fleet, under steam or sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

NAVAL TACTICS.*—Exercises in boats under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal Code.

The instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial, remaining, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.*—Organization and formation of squad, company, and battalion; school of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet exercise.

Text-books.—United States Infantry Tactics; Wingate's Rifle Practice.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States ship Santee.

MORTAR-PRACTICE.

FENCING.—Exercise with small-swords and broadswords.

* Cadet-Midshipmen only.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and surd quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the application of the method, particularly to the projections of the sphere and to the construction of maps.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections; Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display marked ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1878-'79:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with applications to trigonometry and geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and Schools; Todhunter's Theory of Equations; Rice and Johnson's Elements of the Differential Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and details of marine steam-engines, and of instruments and apparatus used in connection with them; the computation of the power and its cost; the duties of the engine-room watch, and of the engineer division.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, and the processes of manufacture, accompanied by practical exercises with the workshop methods and appliances for the conversion of the various materials into finished machinery.

DESIGNING OF MACHINERY.*—Pure mechanism, and the designing of boilers and engines, including valve-gears.

MECHANICAL DRAWING.*—The nomenclature of design; general and conventional practices of the art; the execution of plans, elevations, and sections; isometrical projections; shades, shadows, and linear perspective.

PRACTICAL EXERCISES.—The management of marine steam-apparatus; [the use of tools and machines; hand-work of the machine-shop, pattern-shop, smithery, boiler-shop, and foundry.]*

Text-books.—Weisbach's Mechanics of Engineering, Vol. II; Northcott's Steam-Engine; Warren's Elements of Mechanical Drawing; Willis's Principles of Mechanism; Rankine's Steam-Engine and other Prime Movers; Zeuner's Valve-Motion, and Shelly's Workshop Appliances.

* Cadet-Engineers only.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments, especially those used for determining terrestrial latitudes and longitudes.

Text-books.—C. J. White's *Astronomy*; *Theory of the Portable Transit and the Zenith Telescope*.

NAVIGATION.*—Theory and practice of navigation, the latter including instruction in the duties of the navigator, the use of navigating instruments, and their construction, with the solution of problems and the use of tables.

Text-books.—Coffin's *Navigation*; Merrifield's *Deviation of the Compass*; Bowditch's *Navigator*; Howell's *Marine Surveying*.

SURVEYING.*—The form of the earth, with special reference to the construction of charts; explanation of geodetical surveys; the solution of problems in nautical surveying; and practical work in surveying and constructing charts.

Text-book.—Howell's *Marine Surveying*.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

CHEMISTRY.—General chemistry.

METEOROLOGY AND CLIMATOLOGY.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; effects of heat; instruments used for the measurement of heat; thermodynamics.

PHYSICAL MEASUREMENTS.†—In this course the Cadets are permitted to elect between work in the physical laboratory and work in the chemical laboratory.

The work in the physical laboratory during the year 1877-'78 has consisted in determinations of specific and latent heat; the comparison of several methods of determining the hygrometric state of the atmosphere; the determination of specific gravities; the determination of heat conductivity; the determination of the dip, declination, and intensity of the earth's magnetism; the use of the spectroscope and of the spectrometer; the determination of the indices of refraction; experiments in tempering steel; experiments on the torsional and tensile strength of wires.

The work in the chemical laboratory during the year 1877-'78 embraced blowpipe analysis; crystallography; mineralogy; quantitative analysis.

The course in mineralogy comprised the study in the mineral cabinet of the most commonly recurring minerals, the useful ores, and the objectionable minerals which are frequently associated with them.

The course in quantitative analysis consisted of the gravimetric determination of—
Iron in ammonio-ferrous sulphate.

Copper and tin in gun-metal.

Copper, antimony, and zinc in "white brass."

Tin and lead in solder.

Lead, carbon dioxide, and insoluble residue in a white lead ground in oil.

Valuation of a coal.

The preparation and standardizing of a solution of potassia permanganate by means of iron wire, ammonio-ferrous sulphate, oxalic acid, and ammonic oxalate.

* Cadet-Midshipmen only. † Cadet-Engineers only.

The estimation of iron in an iron salt, and in hematite and magnetite ores by means of the permanganate solution.

Preparation and standardizing of a solution of potassia dichromate.

Estimation of iron in an iron salt by Penny's method.

Text-books.—Stewart's Elementary Physics; Eliot and Storer's Chemical Analysis; Jenkins's Magnetism and Electricity; Stewart's Elementary Treatise on Heat; Miller's Inorganic Chemistry; Kohlrausch's Physical Measurements; Nason and Chandler's Blowpipe Analysis; Dana's Manual of Mineralogy; Thorpe's Quantitative Chemical Analysis.

Reference-books.—Ganot's Physics; Maxwell's Theory of Heat.

ELECTIVE COURSES.

In addition to the above, Cadets who display the greatest ability in the required course are permitted to take extra courses in the laboratories. In the third class this consists of a course in the chemical preparation and study of explosive substances. In the second class they are permitted to elect between a continuation of the chemical course into qualitative analysis or a course in electrical measurements. In the first class, Cadet-Midshipmen, the work consists of a continuation of the electrical measurements of the second class, together with measurements in light and heat.

Cadet-Engineers of the first class have additional practical exercises in chemical analysis every Saturday morning, while the Cadet-Midshipmen exercise in seamanship.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima, and the tracing of curves; the methods of integration and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriiform fluids.*—Laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

THE STRENGTH AND RESISTANCE OF MATERIALS.*—Simple and compound stresses; the relations between strain and stress; the strength and stiffness of beams; beams of uniform resistance.

THE METHOD OF LEAST SQUARES.*—The theory of the method of least squares and the application of the method to results derived from experiments.

THEORETICAL NAVAL ARCHITECTURE.*

Text-books.—Rice and Johnson's Differential Calculus; Williamson's Integral Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; Rankine's Applied Mechanics; Merriman's Method of Least Squares; Wilson's Theoretical and Practical Ship Building.

ELECTIVE COURSES.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in integral calculus and analytical mechanics.

* Cadet-Engineers only.

The course in Theoretical Naval Architecture is elective for Cadet-Midshipmen.

Text-books.—Williamson's Integral Calculus, and Tait and Steele's Dynamics of a particle.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.

International law:—rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable waters; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii*; rights and duties of neutrals; contraband; blockade; right of search; ship's papers; offences against the law of nations.

Outlines of maritime law.

Lectures.

Text-books.—Woolsey's International Law; Andrews's Manual of the Constitution.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1875; historical geography; progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's General Sketch of History, with Labberton's Historical Atlas; Eliot's History of the United States, with modern atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology. Syntax; analysis of sentences.—Readings from standard authors, with applications of the principles of grammar, and exercises in analysis and in tracing the etymological meaning of words.—Classification of words; definition of words by usage and by derivation; synonyms; laws of change in the meaning of words by contraction, extension, and amelioration.—Faults in diction, and their remedies; selection and arrangement; elementary principles of reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Keetel's French Grammar; La Fontaine's Fables; Prud'homme's French Sentential Phrases; Erckmann-Chatelain's *Le Conscrit* and *Waterloo*; Gase's Dictionary; Gase's Spanish Manual; Tolon's Reader; Barrett's Dictionary.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are arranged in four classes, each class pursuing the course for the corresponding year.

PROGRAMME OF RECITATIONS.

The time devoted to daily recitations is divided into three periods, indicated thus:—(1), (2), (3), denotes first period, from 8.20 a. m. to 10.20 a. m.; (2) denotes second period, from 10.35 a. m. to 1 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m.

Practical exercises begin on Saturdays at 8 a. m., from October 1 to December 15, and from March to June 1; and at 10.45 a. m. from December 15 to March 10. On other days except Sundays practical exercises begin at 4 p. m.

FIRST TERM.

From October 1, 1878, to February 1, 1879.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. (2) F. S. (1)	Algebra and Geometry.
English Studies, History, and Law	M. T. W. Th. (1) F. (2)	Elective Course once a week English and History.
Modern Languages	1st division, M. T. Th. (3)	Keetel's French Grammar.
	2d division, M. W. F. (3)	
Drawing	1st division, W. F. (3)	Free-hand Drawing.
	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics	M. T. W. Th. (1) F. (2)	Trigonometry and Descriptive Geometry.
	F. (3)	Descriptive Geometry.
English Studies, History, and Law	M. (2) W. (3) F. (1)	Elective Course once a week History and Rhetoric.
Physics and Chemistry	T. W. Th. (2)	Elementary Physics.
Modern Languages	T. Th. (3)	French.
Drawing	M. (3) S. (1)	Free-hand Drawing.
SECOND CLASS—THIRD YEAR.		
Seamanship	M. (3) F. (2) S. (1)	Luce's Seamanship.
Ordnance and Gunnery	Th. (3)	Infantry Tactics and Ordnance Instructions.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
English Studies, History, and Law	One period a month*	Elective Course twice a week Composition.
Modern Languages	M. T. (2) W. F. (3)	French.
FIRST CLASS—FOURTH YEAR.		
Seamanship	T. Th. (3)	Ship-Building.
Ordnance and Gunnery	F. (3)	Luce's Seamanship.
Steam-Engineering	T. (2) W. (3)	Ordnance and Armour.
Astronomy, Navigation, and Surveying	W. Th. (2) F. (1)	Marine Engines.
Physics and Chemistry	M. T. W. Th. (1)	Navigation.
Modern Languages	M. F. (2) S. (1)	Heat and Light.
	M. (3)	Spanish.

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. (2) F. S. (1)	Algebra and Geometry.
Steam-Engineering	1st division, W. F. (3)	Elective Course once a week Mechanical Drawing.
	2d division, T. Th. (3)	English and History.
English Studies, History, and Law	M. T. W. Th. (1) F. (2)	
Modern Languages	1st division, M. T. Th. (3)	Keetel's French Grammar.
	2d division, M. W. F. (3)	

CADET-ENGINEERS—Continued.

Departments.	Periods.	Subjects.
THIRD CLASS—SECOND YEAR.		
Mathematics	M. T. W. Th. (1) F. (2)	Trigonometry and Descriptive Geometry.
	M. (3)	Descriptive Geometry.
Steam-Engineering	F. (3) S. (1)	Elective Course once a week.
Physics and Chemistry	T. W. Th. (2)	Mechanical Drawing.
English Studies, History, and Law	M. (2) W. (3) F. (1)	Elementary Physics.
Modern Languages	T. Th. (3)	History and Rhetoric.
		French.
SECOND CLASS—THIRD YEAR.		
Steam-Engineering	M. Th. (3) F. (2) S. (1)	Mechanical Drawing, Marine Engines, and Fabrication of Machinery.
Astronomy, Navigation, and Surveying	T. (3) W. Th. (2)	Astronomy.
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)	Calculus.
English Studies, History, and Law	One period a month*	Elective Course twice a week.
Modern Languages	M. T. (2) W. F. (3)	Composition.
		French.
FIRST CLASS—FOURTH YEAR.		
Seamanship	T. Th. (3)	Ship-Building.
Steam-Engineering	M. T. W. Th. F. (1) W. F. (3)	Marine Engines, Fabrication and Designing of Machinery, Mechanical Drawing.
Physics and Chemistry	M. F. (2) S. (1)	Heat and Light.
Mechanics and Applied Mathematics	T. W. Th. (2)	Strength of Materials.
Modern Languages	M. (3)	Spanish.

* Theme Periods.—1. Oct. 8, T. (1), Mechanics. 2. Nov. 11, M. (3) } C. M., Seamanship, }
 3. Dec. 3, T. (2), Modern Languages. 4. Jan. 2, Th. (2), Navigation. } C. E., Steam.

SECOND TERM.

From February 1, 1878, to June 1, 1879.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry.
English Studies, History, and Law	M. T. W. Th. F. (1)	Elective Course once a week.
Modern Languages	1st division, M. T. Th. (3)	English and History.
	2d division, M. W. F. (3)	French.
Drawing	1st division, W. F. (3)	Topography.
	2d division, T. Th. (3)	
THIRD CLASS—SECOND YEAR.		
Mathematics	M. T. W. Th. F. (1)	Analytical Geometry and Descriptive Geometry.
	F. (3)	Elective Course once a week.
Physics and Chemistry	T. Th. F. (2)	Descriptive Geometry.
English Studies, History, and Law	M. W. (2) S. (1)	Chemistry.
Modern Languages	T. W. Th. (3)	History and Rhetoric.
Drawing	M. (3)	French.
		Free-hand Drawing.
SECOND CLASS—THIRD YEAR.		
Seamanship	T. (3) F. (2) [and Th. (3) to March 10]	Luce's Seamanship.
	Th. (2)	Naval Tactics.
Ordnance and Gunnery	T. (2)	Ordnance Instructions.
Physics and Chemistry	M. W. (2) S. (1) [and Th. (3) from March 10 to June 1]	Electricity.

CADET-MIDSHIPMEN—Continued.

Departments.	Periods.	Subjects.
SECOND CLASS—THIRD YEAR.		
Mechanics and Applied Mathematics.....	M. T. W. Th. F. (1).....	{ Mechanics. Elective Course twice a week. Composition. Spanish.
English Studies, History, and Law.....	One period a month*.....	
Modern Languages.....	M. W. F. (3).....	
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	M. W. (2) S. (1).....	{ Luce's Seamanship. Ordnance and Armst. Marine Engines.
Ordnance and Gunnery.....	M. Th. (3) T. (1).....	
Steam-Engineering.....	W. F. (3) Th. (2).....	
Astronomy, Navigation, and Surveying.....	M. W. Th. F. (1).....	{ Navigation and Surveying. Elective Course in Naval Architecture. Public Law. Spanish.
Mechanics and Applied Mathematics.....	Th. (2).....	
English Studies, History, and Law.....	T. F. (2).....	
Modern Languages.....	T. (3).....	

* Theme Periods.—1. Oct. 8, T. (1), Mechanics. 2. Nov. 11, M. (3) { C. M., Seamanship, }
 3. Dec. 3, T. (2), Modern Languages. 4. Jan. 2, Th. (2), Navigation. { C. E., Steam. }

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	M. T. W. Th. F. (2) S. (1).....	{ Algebra and Geometry. Elective Course once a week. Mechanical and Drawing. English and History. French.
Steam-Engineering.....	1st division, W. F. (3).....	
English Studies, History, and Law.....	2d division, T. Th. (3).....	
Modern Languages.....	M. T. W. Th. F. (1).....	
	1st division, M. T. Th. (3).....	
	2d division, M. W. F. (3).....	
FIRST CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1).....	{ Analytical Geometry and Descriptive Geometry. Elective Course once a week. Descriptive Geometry. Mechanical Drawing. Chemistry. History and Rhetoric. French.
Steam-Engineering.....	M. (3).....	
Physics and Chemistry.....	F. (3).....	
English Studies, History, and Law.....	T. Th. F. (2).....	
Modern Languages.....	M. W. (2) S. (1).....	
	T. W. Th. (3).....	
SECOND CLASS—THIRD YEAR.		
Steam-Engineering.....	T. Th. F. (2) T. (3) [and Th. (3) to March 10.]	{ Mechanical Drawing, Fabrication of Machinery, and Marine Engines. Electricity.
Physics and Chemistry.....	M. W. (2) S. (1) [and Th. (3) from March 10 to June 1.]	
Mechanics and Applied Mathematics.....	M. T. W. Th. F. (1).....	{ Mechanics. Elective Course twice a week. Composition. Spanish.
English Studies, History, and Law.....	One period a month*.....	
Modern Languages.....	M. W. F. (3).....	
FIRST CLASS—FOURTH YEAR.		
Steam-Engineering.....	M. W. Th. F. S. (1) W. (2).....	{ Marine Engines, Fabrication and Designing of Machinery, and Mechanical Drawing. Physical Measurements. The Method of Least Squares. Naval Architecture. Public Law. Spanish.
Physics and Chemistry.....	Th. F. (3).....	
Mechanics and Applied Mathematics.....	T. (1) M. W. (3).....	
English Studies, History, and Law.....	M. (2).....	
Modern Languages.....	Th. (2).....	
	T. F. (2).....	
	T. (3).....	

* Theme Periods.—1. Feb. 7, F. (2), { C. M., Seamanship, } 2. Mar. 11, Tu. (1), Mechanics. 3. Apr. 1, F. (3), Modern Languages. 4. May 5, M. (2), Physics and Chemistry. { C. E., Steam. }

EXAMINATION PAPERS—1877-78.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878:—Time allowed, five hours.

[Two questions may be omitted.]

1. Simplify $(a+b)^2(b+c-a)(c+a-b) + (a-b)^2(a+b+c)(a+b-c)$. Divide $x^6 - 3x^5 - 31x^4 + 25x^3 + 3x^2 - 15x - 8x^3 + 19x^2 + 3x + 10$ by $x^4 - 7x^3 + 3x - 2$, giving the quotient and remainder. Resolve into factors $a^2 + 9ab + 20b^2$, $x^2 - 13xy + 42y^2$, $x^6 + y^6 - 2x^3y^3$, and $x^3 - 3x + 2$.

2. Find the greatest common divisor of $x^3 - 4x^2 + 2x + 3$, and $2x^4 - 9x^3 + 12x^2 - 7$, and the least common multiple of $x^2 + 2x - 3$, $x^3 + 3x^2 - x - 3$, and $x^3 + 4x^2 + x - 6$.

3. Simplify

$$\frac{1}{x^2 - 7x + 12} + \frac{2}{x^2 - 4x + 3} - \frac{3}{x^2 - 5x + 4}.$$

and

$$\frac{x^2 + (a+c)x + ac}{x^2 + (b+c)x + bc} \div \frac{x^2 - a^2}{x^2 - b^2}.$$

Find the value of

$$\frac{x}{a} + \frac{x}{b-a} - \frac{a}{a+b}$$

when

$$x = \frac{a^2(b-a)}{b(b+a)}.$$

4. Solve the equations

$$\frac{3x-1}{5} - \frac{13-x}{2} = \frac{7x}{3} - \frac{11}{6}(x+3),$$

$$\frac{x-a}{x-b} = \frac{(2x-a)^2}{(2x-b)^2}.$$

$$\sqrt{x+14} + \sqrt{x-14} = 14,$$

and

$$\frac{x+10}{3} - \frac{2}{5}(3x-4) + \frac{(3x-2)(2x-3)}{6} = x^2 - \frac{2}{15}.$$

5. Prove that if

$$\frac{a}{b} = \frac{c}{d},$$

then

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}.$$

Prove that when a and b are unequal $a^2 + b^2 > 2ab$. Find which is the greater,

$$2 + \sqrt{3} \text{ or } 5 - \sqrt{2}.$$

Find the square root of

$$\frac{19}{15} - 2\sqrt{\frac{2}{5}}.$$

6. Write the 2d, 3d, and 4th powers of $3 - \sqrt{5}$, and the 3d and 4th powers of $x + 2y + 3z$. Find the coefficient of $x^2 y^3$ in the expansion of $(x + y + z)^{10}$.

7. Find the cube root of 418.9 to five decimal places. Expand

$$\frac{1}{\sqrt{a^2 - x^2}}$$

to five terms by the binomial formula.

8. Solve the equations

$$\frac{x-1}{x-4} - \frac{x-3}{x-2} = \frac{11}{12}, \quad (x+10)^2 = 144(100-x)^2,$$

and

$$x^4 - 4x^2 + 2\sqrt{x^4 - 4x^2 + 4} = 31.$$

9. Show that

$$\frac{bc(a+d)}{(a-b)(a-c)} + \frac{ac(b+d)}{(b-a)(b-c)} + \frac{ab(c+d)}{(c-a)(c-d)} = d.$$

Resolve $2x^2y^2 + 2x^2z^2 + 2y^2z^2 - x^4 - y^4 - z^4$ into four factors.

10. Solve the equations

$$\sqrt{\frac{x^2-2x+3}{x^2+2x+4}} + \sqrt{\frac{x^2+2x+4}{x^2-2x+3}} = 2\frac{1}{2},$$

and

$$\frac{x+y}{4} = \frac{xy}{x+y} + \frac{1}{2}, \quad x^2 + y^2 = \frac{8x^2y^2}{(x+y)^2} + 22.$$

11. The distance between two termini, *A* and *F*, of a railway is 100 miles; a train starting from *A* runs up grade for 30 miles, the next 50 miles are on a level, and the remainder is up hill again. The train makes 5 miles an hour more on a level than when ascending a grade. There are four stops at stations *B*, *C*, *D*, and *E*, at distances 20, $42\frac{1}{2}$, $67\frac{1}{2}$, and 90 miles from *A* respectively; each stop causes a detention of 3 minutes. Find the time of arrival at each of the stations of a train which leaves *A* at 8 and arrives at *F* at 12.42.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

[Two questions may be omitted.]

1. Deduce the formula for the sum of an arithmetical progression in terms of *a*, *d*, and *n*. Deduce a formula for *n* in terms of *a*, *d*, and *s*. Find the sum of *s* terms of a series whose *n*th term is $\frac{4n+1}{5}$, and find the *n*th term of a series whose sum is $\frac{9n^2+19n}{4}$.

2. Find the sum of 15 terms of the series $\frac{2}{3} + \frac{5}{7} + \frac{16}{21} + \&c.$ Find the sum to infinity of $2 + \sqrt{\frac{2}{3}} + \frac{2}{3} + \&c.$ The sum of an infinite geometrical progression is 3, and the sum of the first two terms is $2\frac{3}{8}$; find the series.

3. Expand $\sqrt{1+x+x^2+x^3} + \&c.$ to four terms by means of indeterminate coefficients. Separate $\frac{x^2-3x+1}{(x^2-8x+12)(x^2+x-20)}$ into partial fractions, with denominators of the first degree.

4. Find the first three terms of a series whose $(n+1)$ th term is $\frac{(n+7)(n-5)}{(n+1)(n^2+1)} \cdot 2^n$. How many different signals may be made with twelve different flags hoisted one above another, four at a time? In how many of these signals will a particular flag occur?

5. Find the value of the expression $\left\{ \frac{a^3b^2c + a^2b^3c^2}{d^3ef^2 + d^2e^3f} \right\}^{\frac{1}{2}}$, given *a*, .15736; *b*, .48192; *c*, .056894; *d*, .00043141; *e*, 5.8404; *f*, 98218.

6. Find the value of the following expressions:

$$(1.007)^{224}, (.001875)^{\frac{1}{2}}, \text{ and } (.001875)^{.001875}.$$

Find the modulus of a system of logarithms whose base is $e^{\frac{1}{2}}$.

7. Find an equation whose roots are less by 5 than those of the equation $x^4 + 25x^3 - 70x^2 + 16x - 972 = 0$. Transform the equation $x^3 - 6x^2 + 9x - 10 = 0$ into

another wanting the second term, and into two others each wanting the third term. Find an equation whose roots are $3 \pm \sqrt{5}$ and $7 \pm \sqrt{2}$, and find all the roots of the equation $x^5 - 3x^4 - 9x^3 + 21x^2 - 10x + 24 = 0$.

8. Solve the equation $x^4 + 4x^3 - 10x^2 + 4x + 1 = 0$. Transform the equation $x^4 + ax^3 + bx + c = 0$ to another, whose roots are the squares of the roots of the given one; thence find an expression for the sum of the squares of the roots of the given equation.

9. Find, by means of indeterminate coefficients, the sum of n terms of the series $2 + 5 + 9 + 14 + 20 + \&c$. The number of combinations of $n + 2$ things taken three together is 11 times the number of combinations of $\frac{2n}{3}$ things taken two together; find n .

10. Trace the locus of the equation

$$4y^2 - 4xy + 5x^2 - 32y - 16x - 68 = 0.$$

11. Given the equations $x^2 + y = 11$, $y^2 + x = 7$; find the commensurable values of x and y ; find also a positive value of x to five decimal places.

GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, five hours.

[Two questions may be omitted.]

1. Define *right angle*, *perpendicular*, and *geometric locus*; give three examples of the latter. Prove that the sum of the angles of a triangle is two right angles. Name and define the different classes of quadrilaterals and parallelograms, giving a figure of each.

2. Define *circle*, *chord*, *sector*, and *segment*. Prove that an inscribed angle is measured by one-half the intercepted arc. Construct common tangents to two circles, interior and exterior, and explain the construction.

3. Explain the terms *similar polygons*, *homologous lines*, *ratio of similitude*. When are triangles similar? (Quote the propositions.) Prove that the bisector of an angle of a triangle, or of its exterior angle, divides the opposite side into segments, internally or externally, which are proportional to the adjacent sides.

4. Give the geometrical proof that the sum of the squares described upon the sides of a right triangle is equivalent to the square described upon the hypotenuse. Divide a line 3 inches long in extreme and mean ratio; explain the construction and give algebraic expressions for the segments.

5. What is a *regular polygon*? What is the *apothegm*? Show how to inscribe a square, hexagon, and decagon in a circle (give a brief proof in each case). Prove that the area of a regular dodecagon is three times the square of the radius.

6. Define *polyhedron*, *regular polyhedron*, *prism*, and *parallelopiped*. What regular polyhedrons are there? Prove that the volume of any parallelopiped is equal to the product of its base by its altitude, and that a triangular pyramid is one-third of a triangular prism of the same base and altitude.

7. Define *conical surface*, *nappes*, *generatrix*, *directrix*, *element*. Through a given point pass a plane tangent to a given cylinder. Define *spherical triangle*, *polar triangles*. Prove that in two polar triangles each angle of the one is measured by the supplement of the side lying opposite to it in the other.

8. Define sine, cosine, tangent, and secant; find these functions of the angles 30° , 45° , 60° , $22\frac{1}{2}^\circ$, and 15° .

9. The sides of a right triangle are a and b , hypotenuse c ; upon the side b a similar triangle is described with b as its hypotenuse, and upon the corresponding side of this another similar triangle is described in the same manner, and so on *ad infinitum*; find the sum of the areas of all these triangles.

10. The figure being drawn for the proposition in question 4, let AB be the hypotenuse, CF the perpendicular upon it from the right angle, AD and BE , lines drawn from the most distant corners of the square described on BC and AC ; prove that CF , AD and BE meet in a point.

11. In the preceding question, the hypothenuse being fixed, find the locus of point C , and also of the points D and E .

THEORY OF EQUATIONS.

ELECTIVE COURSE.

JUNE, 1878.—Time allowed, five hours.

Cadet-Midshipmen J. L. Shock, J. H. Linnard, J. L. Rees, Tasaker Scrata, Eugene Carr and J. J. Woodward.

1. Given the equation $(y-2x)(y^2-x^2)-a(y-x)^2+4a^2(x+y)-a^3=0$.

() Find the equations to the asymptotes.

(3) Find the co-ordinates of the intersections of the curve with its asymptotes.

(7) Denoting these co-ordinates by (x_1, y_1) , (x_2, y_2) , (x_3, y_3) , show that

$$\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = 0.$$

(d) Find to the nearest tenth in terms of a the distance from the origin to each of the points where the curve crosses the axes.

(e) Make a sketch of the locus, using only the data already determined.

2. Discuss by means of Sturm's functions the equation $x^4-3x^2+9x+2x-1=0$ ($f_4(x)$ is negative.) Find the value of the numerically greatest root to eight decimal places.

3. Find the values of the symmetrical functions $\Sigma(a^4)$ and $\Sigma(a^2b^2)$ of the roots of $f(x)=0$ in terms of the coefficients p_1, p_2 , &c. Given $x+y+z=0$, $(b+c)x+(c+a)(a+b)z=0$, $bex+acy+abz=1$; find x, y , and z by means of determinants.

4. Trace the locus of the equation $ax^2(y-a)=y^3(x-2a)$, and find the co-ordinates of the points where the tangent is parallel to the axis of X .

5. Trace the locus of the equation $a^2(x^2-y^2)+2axy^2+ay^3-x^4-x^2y^2=0$.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY 30, 1878.—Time allowed, five hours.

1. Fix the geographical position of the following nations, and tell what you are of the classification and language of each: 1. Bulgarians; 2. Roumanians; 3. Magyars; 4. Turks; 5. Russians.

2. "The best life of Scandinavia went out into other lands to put new life there." Give some instances of this.

"He won the rank of Roman emperor for the German kings." Who is alluded to in this passage, and how was the transfer in question accomplished?

3. Name the seven electors. How was it that the mediæval Roman empire was elective and hereditary, while the French monarchy became strictly hereditary?

4. Show that the later Roman republic was nominally a pure democracy, but with aristocratic tendencies.

5. What change was made in the relations of England and Scotland in 1603-1707? What did Edward III. give up by the peace of Breteuil? What did he lose

What change did Simon of Montfort make in the English Parliament, and when? How was Normandy lost to England? How did the Angevin kings come to the throne of England?

6. Explain the origin and meaning of the names Protestant, Maid of Orleans, Latin Empire of Constantinople, Babylonish Captivity, Pagan, Langue d'oïl and Langue d'oil.

7. Describe the government of Venice in the fifteenth century, and show how it differed from that of Florence. Compare the origin and position of the Medici at Florence with those of Sforza at Milan.

8. "At the moment that Greece began to lose her political freedom she made an intellectual conquest of a large part of the world." Tell what this means, and show why it was so. Give some account of: 1. Miltiades; 2. Polybios; 3. Solon. Where was Mantinea, and why is it celebrated in history?

9. Distinguish between Arians and Aryans. What nation made the first conquest of what is now known as England? the second? the third? the fourth and last? Explain the difference between allodial holdings and fiefs, and show why the latter took the place of the former.

10. Draw a map of Central and Western Europe in 1400 A. D., putting down the position and boundaries of the following:

- | | | |
|---------------|---------------|---------------|
| 1. Agincourt. | 7. Styria. | 13. Prag. |
| 2. Sempach. | 8. Morgarten. | 14. Milan. |
| 3. Bohemia. | 9. Avignon. | 15. Creecy. |
| 4. Mainz. | 10. Geneva. | 16. Provence. |
| 5. Lorraine. | 11. Pisa. | 17. Courtrai. |
| 6. Köln. | 12. Constanz. | 18. Savoy. |

HISTORY OF THE UNITED STATES.

ANNUAL EXAMINATION.

JUNE 5, 1878.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

1. What is a representative assembly? What was the first representative assembly in America? What was the general character of the assemblies in the colonies? Describe the government of Plymouth Colony.

2. Compare the policy of Maryland with that of Massachusetts and Rhode Island, in regard to religious toleration, and explain the causes in each case.

3. Make a statement of Franklin's services: 1. As deputy to the Albany convention of 1754. 2. In England, in regard to the Stamp Act. 3. In 1775. 4. In 1776-78. 5. In 1783. 6. In 1787.

3.* Describe the work of the three French explorers: 1. Marquette; 2. La Salle; 3. D'Iberville.

4. Give some account of the financial measures adopted at the beginning of Washington's administration.

4.* Explain the party divisions in the Constitutional Convention, and state the points in discussion on the question of apportionment of representation, showing how the question was settled.

5. Give some account of the following: 1. Affair of the Chesapeake. 2. Greene's campaign in South Carolina during the Revolution. 3. Jackson in Louisiana in the war of 1812. 4. Affair of the Caroline. 5. Wilmot Proviso. 6. Dred Scott case. *Take four.*

6. Describe the actions on the lakes in the war of 1812.

6.* Describe the English naval and military expedition on Baltimore and Washington.

7. Explain the Monroe Doctrine, and show how far it influenced American politics.
 8. Explain tariff, protection, prohibition, free trade. Explain the tariff measures of 1816, 1828, and 1832, and give an account of the action of South Carolina in reference to the last.

9. Give an account of General Scott's campaign from Vera Cruz to the City of Mexico.

9.* Give an account of the repeal of the Missouri Compromise, and explain its connection with the civil war in Kansas.

10. Draw a map of the States south of the Ohio River, putting down the following:

- | | | |
|-----------------------|------------------|--------------------|
| 1. Ohio River. | 7. Lexington. | 13. Fort Donelson. |
| 2. Mississippi River. | 8. Louisville. | 14. Fort Pillow. |
| 3. Kentucky River. | 9. Perrysville. | 15. Nashville. |
| 4. Cumberland River. | 10. Chickamauga. | 16. Chattanooga. |
| 5. Knoxville. | 11. Vicksburg. | 17. Port Hudson. |
| 6. Corinth. | 12.* Memphis. | 18. New Orleans. |

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY 28, 1878.—Time allowed, five hours.

1. Explain the term Norman Conquest as applied to the English language. How did the Norman Conquest affect the English vocabulary?

2. What is meant by Classical Latin, and how did it affect the language of England?

3. Describe the early loss of inflections in Northern England, and account for the difference between the South and North in this respect.

4. To what extent is an English verb inflected? In the absence of inflections, how are moods and tenses distinguished? (Explain each mood and tense.) Explain aorist tense, finite verb, strong conjugation.

5. Give all the plurals of the following, adding the rule in the first four cases: 1. Bandit; 2. Echo; 3. Child; 4. Commander-in-chief; 5. Cherub; 6. Trellis; 7. Oasis; 8. Fief; 9. Sheaf; 10. Talisman. Explain the formation of: 1. Youngster; 2. Kine; 3. Children; 4. Vixen; 5. Rather.

6. (a) Explain the force of *shall* and *will* in the following: 1. I say that you *will* go. 2. You say that he *shall* go. 3. He says that he *shall* go. 4. I say that I *will* go.

(b) Explain the terminations in *liquefy*, *verbose*, *ringlet*.

7. Analyze:

"If, by gaining knowledge, we destroy our health, we labor for a thing that will be useless in our hands; and if, by harassing our bodies (though with a design to render ourselves more useful), we deprive ourselves of the ability of doing the good we might have done with a meaner talent, which God thought sufficient for us by having denied us the strength to improve it to that pitch which men of stronger constitutions can attain to, we rob God of so much service, and our neighbor of all that help which, in a state of health, we might have performed."

8. As it is in the body, so it is in the mind; practice makes it what it is; and most, even of those excellencies which are looked on as natural endowments, will be found, when examined into more narrowly, to be the product of exercises, and to be raised to that pitch only by repeated actions. Some men are remarked for their skill in rallery, others for diverting stories. This is apt to be taken for the effect of pure nature, and that, the rather, because it is not got by rules, and those who excel in either of them never set themselves to the study of it as an art to be learnt. Parse all the words underlined, classifying and explaining the principal parts of the verbs.

ENGLISH LESSONS.

ANNUAL EXAMINATION.

JUNE 10, 1878.—*Time allowed, five hours.*

1. "To increase one's vocabulary does not imply increasing the number of one's notions." Show this.

Explain generalizing. What is meant by false generalization?

2. Name the laws of linguistic change and give an illustration of each, showing from the etymology of the word how the law applies.

3. Show that impassioned prose may approximate to the (a) metre, (b) brevity, of poetry. In what point does the best prose of this kind keep itself distinct from poetry? When are poetic quotations and periphrases admissible and when not?

4. Explain, with original examples, personification and personal metaphor, and show why one admits of expansion and the other does not.

5. Define rhetorical period, epic poem, dramatic poem, syllogism, convertible proposition.

6. Show that the value of evidence depends on all the other sources of knowledge. What is meant by false generalization? by authority as a source of prejudice? by the argument from analogy?

7. Explain all the figures in the following passage:

"I have marshalled my clan;
 Their swords are a thousand; their bosoms are one.
 They are true to the last of their blood and their breath,
 And like reapers descend to the harvest of death.
 Then welcome be Cumberland's steed to the shock!
 Let him dash his proud foam like a wave on the rock!
 But woe to his kindred, and woe to his cause,
 When Albyn her claymore indignantly draws."

8. "Anything is excused by necessity. I am under the necessity to preserve my life. Anything that I do to preserve my life is excusable." Explain fully this form of reasoning, and discuss the question as to the correctness of the inference. Point out the major term, middle term, minor premise.

9. "As a promise or contract between two individuals obtained by compulsion is void, so a treaty of peace, in which the victorious enemy has dictated terms to the vanquished, may be broken by the latter at pleasure." Discuss this and point out any error you may see.

10. Make a prose version of the following passage, suppressing rhyme, metre, and poetic diction:

"The curfew tolls the knell of parting day;
 The lowing herds wind slowly o'er the lea,
 The ploughman homeward plods his weary way,
 And leaves the world to darkness and to me.

"Now fades the glimmering landscape on the sight,
 And all the air a solemn stillness holds,
 Save where the beetle wheels his droning flight,
 And drowsy tinklings lull the distant folds.

"Save that from yonder ivy-mantled tower
 The moping owl does to the moon complain
 Of such as, wandering near her secret bower,
 Molest her ancient solitary reign."

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE 10, 1876.—*Time allowed, four hours.*

Translate into French the following sentences:

1. Do you expect to go to France in the spring?
2. We intend going there. I would like to go, because I speak French.
3. How long will you remain in Europe?
4. We propose staying one year in France, afterwards six months in Germany; the end of eighteen months we will return to America.
5. Can you tell me which is the most populous and most commercial city in France?
6. I think it is Paris.
7. In what hotel do you live when you are there?
8. We stay at the Hotel du Louvre, in Rivoli street.
9. How many rooms do you generally take?
10. We always take three rooms; one for father and mother, one for sister, and for myself.
11. Do you take with you a servant from the United States?
12. Yes, sir; because we have had him a long time, and also because father does not speak French.
13. What do you do in the evening to pass the time?
14. After dinner, if the weather is fine, we take a drive, sometimes we walk, we often go to the theatre.
15. Do you ever visit other cities in France?
16. We have visited a great many cities in that country, but never many in Germany; but this time we intend visiting the principal cities of that empire.
17. Why don't you go to Italy also?
18. If father's affairs and health allow it, I hope to have that pleasure.
19. If you do go, I will send you letters of introduction to my friends.
20. I am delighted to hear you say so, and thank you very much.

THIRD CLASS.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

[Solutions of ten questions required.—Without tables.]

1. Define *sine* and *cosine*. The sines and cosines of two angles being given, find the sine and cosine of their sum and difference. Deduce formulas for the tangent of $(x \pm y)$, and for the sum and difference of the sines and cosines of x and y .
2. Deduce formulas expressing the sine, cosine, and tangent of $2x$ and $\frac{1}{2}x$ in terms of the functions of x . Find the sine and cosine of 30° and 45° and thence derive the sine and cosine of 15° and $22\frac{1}{2}^\circ$. Find the sine and cosine of 18° . Find the square root of $\cos \theta + \sqrt{-1} \sin \theta$.
3. Give a rule for finding the circular measure of an arc which is expressed in degrees and minutes, and for finding the degrees and minutes in an arc expressed in circular measure. What is the unit of circular measure? What is meant by the equal

$\sin^{-1} \tan^{-1} 2 \theta$. Give one solution. Find the value of $\sin(\sin^{-1} \frac{1}{2} + \cos^{-1} \frac{1}{2})$. Solve the equation $\tan^{-1} \frac{1}{4} + 2 \tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{6} + \tan^{-1} \frac{1}{x} = \frac{\pi}{4}$.

4. Find an expression for $\cos \frac{1}{2} A$ in a plane triangle in terms of the sides. Deduce formulas for the solution of a plane triangle by means of a perpendicular, (1) when a , b , and A are given, (2) when a , b , and c are given.

5. One side of a triangle is double another and the included angle is 60° ; find the other angles. The sides of a triangle are $x^2 + x + 1$, $x^2 - 1$, and $2x + 1$; find the angle opposite the side $x^2 + x + 1$, and the area of the triangle.

6. State the *three-point problem* and deduce formulas for its solution. Find formulas for the logarithmic solution of $m \cos z + n \sin z = q$, and $\tan(+z) \tan z = m$.

7. Derive the formula $\sin a \sin B = \sin b \sin A$, directly from

$$\cos a = \cos b \cos c + \sin b \sin c \cos A.$$

Find an expression for $\cos \frac{1}{2} A$ in a spherical triangle in terms of the sides; apply this formula to the astronomical triangle to find Z , when d , h , and L are given. Arrange a form for computation.

8. Deduce directly from the fundamental theorems of spherical trigonometry all the formulas used in the solution of right triangles. Give the rule for drawing the perpendicular in the solution of oblique triangles. One side of a triangle is 90° and the adjacent angles are 30° and 45° ; find the other angle.

9. In a plane triangle, given A , 45° ; B , $\tan^{-1} \frac{17}{31}$; c , 48: solve the triangle, and find the perpendicular from C upon a .

10. In a spherical triangle, given A , 30° ; B , 105° ; c , $\tan^{-1} 2$: find a and C .

11. Derive $a \sin B = b \sin A$ from the formulas $a^2 = b^2 + c^2 - 2bc \cos A$. The shadows of two walls, which run at right angles to each other and which are respectively a feet and b feet in height, are observed when the sun is due south, and found to be c feet and d feet broad respectively; find the altitude of the sun, and the angle of the first wall with the meridian.

12. The distance between the centres of two wheels is a , and the sum of the radii is c ; find the length of a string which crosses between them and just wraps around them.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—Time allowed, five hours.

[Solutions of nine questions required.]

1. Take from the tables the following logarithms: $\text{Cosec } 179^\circ 50' 10''$, $\cos 189^\circ 34' 50''$, $\sec - (90^\circ 30' 30'')$, $\tan 619^\circ 45' 30''$. Find the angles corresponding to the tabular logarithms in the quadrants indicated, $\tan 8.89193$ (4th), $\cos 8.06396$ (7th), and $\sec 10.07938$ (3d). Find the versine of chord $^{-1} \sqrt{s, x}$.

2. In a plane triangle, given A , $36^\circ 44' 15''$; a , 140.15; b , 200.91: solve the triangle and find its area.

3. Draw a triangle ABC and let P be a point without the triangle. Find the angles $\angle CAP$ and $\angle CBP$, given AB , 62712; BC , 39195; AC , 31356; $\angle APC$, $37^\circ 30'$; $\angle BPC$, $45^\circ 30'$.

4. In a plane triangle, given a , 4325; b , 5175; c , 7650; find the angles, using a perpendicular from the greatest angle upon the opposite side. Find the radii of the inscribed and circumscribed circles and the distance between their centres.

5. In a spherical triangle, given A , $129^\circ 15' 45''$; B , $140^\circ 4' 15''$; b , $126^\circ 29' 30''$: find a and C .

6. In a spherical triangle, given C , $131^\circ 11' 12''$; A , $69^\circ 14'$; b , $84^\circ 29' 20''$: solve the triangle.

7. Given t , $30^\circ E$; d , $7^\circ 30' N$; h , 45° : find L and Z . Project the triangle on the plane of the equator.

8. In the quadrilateral $ABCD$, given AB , 5280.9; BC , 6080.5; AD , 3520.8; $\angle A$, $30^\circ 25'$; and $\angle CAD$, $60^\circ 30'$: find AC and DC .

9. Find the roots of the equation $x^3 - 6x^2 + 11.25x - 6.32245 = 0$.

10. Given $a, 90.024$; $b, 120.03$; $\alpha, 19^\circ 41' 45''$; $\beta, 49^\circ 2' 30''$; $\phi, 75^\circ 22' 3''$; and that

find x from the formulas, $\tan^2 y = \frac{4ab \sin \theta \sin (\phi - a)}{(a-b)^2 \sin a \sin (\phi - \theta)}$, $x = \frac{a-b}{2} \sec y - \frac{a+}{2}$

11. Find to the nearest second a value of θ between 66° and 67° which will the equation $\theta = \tan^{-1} 2 \theta$.

DESCRIPTIVE GEOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—Time allowed, four hours.

[Use a fresh sheet for each question, and draw the ground-line 4 inches from the top of the page. The work of each question must be included between two lines, one drawn on each side of the line, and $2\frac{1}{2}$ inches from it. A brief statement of the analysis and method of construction in each case is required.]

1. Find the intersection of two planes; (α .) the traces meet the ground-line at (0, 0, 0) and (1.5, 0, 0) and intersect at (1, 1, 0) and (0.5, 0, 1.5). (β .) The traces of the ground-line at (1.75, 0, 0) and (3.5, 0, 0) and intersect at (2.5, 3, 0) and (2.5, 0, 1). (γ .) The planes are parallel to the ground-line, one passes through (4.5, 2, 0) and (4.5, 0, 1), the other through (4.5, 1.5, 0) and (4.5, 0, 1.5). (δ .) The traces of the ground-line at (6.5, 0, 0), one passes through (5, 2.5, 0) and (7, 0, 2.5), the other through (7.5, 1.5, 0) and (5, 0, 2.5).

2. Find the point in which the line (7, 2.5, 2.5) . . . (1.5, 1, 0) pierces the plane (3, 2, 0), (3, 0, 2.5). Find also where the plane is pierced by a line through (1, 2, 0) parallel to the ground-line. The vertical projection of a point in the given plane is (1.5, 0, 1.5); find its horizontal projection.

3. Through (5.5, 1, 2.5) draw a line perpendicular to a plane given as is given. Find the distance of the point from the plane, and project upon the plane a line which passes through the given point and (1, 2, 0).

4. Find the shortest distance from (3, 2, 2.5) to (1, 2.5, 0) . . . (3, 0, 1.25). Find the angle between two planes; the traces meet the ground-line at (4.5, 0, 0) and (1, 0, 0) and intersect at (5, 0, 2.5) and (6.5, 2.5, 0).

5. Construct a regular hexagon in H , centre at (3.5, 1.25, 0), radius 1 inch, one vertex being on a line joining the centre with (2.5, 0, 0). Find the projection of a pyramid whose base is the hexagon and whose vertex is (7, 2.5, 2.5). Find the true form of the section of the pyramid by the plane (6, 0, 0), (4, 2.5, 0), (4, 0, 1).

6. Through (4, 1, 1) draw a line which shall make an angle of 45° with H and V .

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, four hours.

[Take a fresh sheet for each problem and give a brief statement of the methods used in the solution.]

1. Given two lines (1, 2.25, 2.25) . . . (4, 1.75, 0), and (2.5, -0.5, -0.5) . . . (4, 2, 0); find the shortest distance between them.

2. Pass a plane through the point (4, 1, 1), which shall make angles of 45° with H and V , respectively.

3. In a spherical triangle, given $A, 60^\circ$; $b, 45^\circ$; $c, 30^\circ$; make an orthographic projection of the trihedral angle; take the vertex at (4, 3, 0) and place b in H , solve the angle by revolving B and a upon H , and C upon V .

4. In a spherical triangle, given $A, 45^\circ$; $c, 60^\circ$; $a, 45^\circ$; solve the triangle, the vertex at (4, 2, 0) and place c in H to the right of the vertex, both solutions required.

5. A circle, radius 1 inch, is situated in the plane (1, 0, 0), (3, 4, 0), (3, 0, 1), the horizontal projection of the centre being at (4, 2, 0); this circle forms the base

right cylinder, and it is required to draw tangent planes to the cylinder through (3, 5.25, 0).

6. A circle, radius 1 inch, lies in a vertical plane and revolves about a vertical axis through (4, 2.5, 0), the initial position of the centre is (5.5, 2.5, 1.25). A plane parallel to the ground-line passes through (4, 2.5, 1.5) making an angle of 45° with both H and V . Draw the intersection of the plane with the ring which is generated by the circle. Draw a tangent to the curve at each of the points situated 1 inch above H .

ANALYTICAL GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, five hours.

1. Given the vertices of a triangle, (4, 4), (5, 11), and (12, 10); find, (1) the equations to the sides of the triangle, (2) the angles of the triangle, (3) the area, (4) the equation to the circumscribed circle.

2. Deduce the formulas by which the axes are turned through an angle θ , the origin being fixed. Find the equation to the parabola $y^2 = 4ax$, (1) origin at $(a, 2a)$, (2) when the tangent and normal at $(a, 2a)$ are taken as axes.

3. Deduce the equations to the tangent and normal to the parabola (both forms); prove that perpendicular tangents meet on the directrix, and that the chord of contact passes through the focus. Find the equations to tangents to $y^2 = 4ax$ through $(6a, 5a)$.

4. Deduce the rectangular equation to the ellipse, (1) origin at foot of directrix, (2) at vertex, (3) at centre. Find the polar equation, pole at left focus, by moving the origin to that point and then transforming to polar co-ordinates. Find the length of a focal chord in terms of θ . Trace the locus of the equation $r = \frac{a(1-e^2)}{1-e\cos\theta}$, $e > 1$ from

$\theta = \pi$ to $\theta = 2\pi$, showing the motion of the tracing-point by means of arrow-heads.

5. Deduce the equation to the hyperbola referred to its asymptotes. Prove that any secant intercepts equal distances between the curve and each of the asymptotes. Find the equation to the hyperbola whose transverse axis is a and whose vertex bisects the distance between the centre and the focus. The equation to a diameter to $xy = 16$ is $y = 4x$; what is the equation to the conjugate?

6. Construct the locus of the equation $y^2 - 2xy + 2x^2 + 8y + 6x + 49 = 0$. Find the equation to this conic when referred to its axes. State, and prove the method used in constructing the conic.

7. Construct the locus of the equation $y^2 - 2xy + x^2 - 8y + 9x + 10 = 0$. State and prove the method used in the construction. Find the equation to the directrix of the conic given above, and the co-ordinates of the focus.

8. Two equal parabolas have a common directrix and extend in opposite directions; it is required to find the locus of the vertex of a right angle, one of whose sides lies on each of the parabolas. Trace the curve.

DIFFERENTIAL AND INTEGRAL CALCULUS.

ELECTIVE COURSE.

JUNE, 1878.—Time allowed, five hours.

Cadet-Midshipmen P. R. Alger, J. B. Bernadou, L. S. Norton, H. G. Dresel, W. H. Wolfersberger, Harry Phelps, A. A. Ackerman, J. C. Drake, and G. E. West.

Cadet-Engineers W. F. Durand, W. F. C. Hasson, A. W. Stahl, W. S. Sample, and L. D. Miner.

1. Show that if U and V are such functions of x as to vanish when $x = a$, then

$$\frac{V}{U} \Big|_{x=a} = \frac{dV}{dU} \Big|_{x=a}.$$

Evaluate

$$\frac{e^x + \log \left(\frac{1-x}{e} \right)}{\tan x - x} \Bigg|_0^1, \text{ and } (1-x)^{\frac{1}{x}} \Bigg|_0^1.$$

2. Explain the terms *point of inflection*, *conjugate point*, *ramploid* and *ceratoid cusp*, *point d'arrêt*, *branche pointillée*. Trace the curve $y^2 = 1 - x$.

3. Given $r \sin 4\theta = a \sin 3\theta$, find the asymptotes and trace the curve.

4. Find a general expression for the radius of curvature in $x^{\frac{1}{2}} + y^{\frac{1}{2}} = a^{\frac{1}{2}}$. Derive formula for the radius of curvature in terms of p and r . Given $r = a \sec \frac{2\theta}{3}$, find p .

5. Define evolute and involute; derive formulas for the co-ordinates of a point on the evolute. Find the equation to the evolute of $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.

6. A series of ellipses have the same centre and directrix, find the envelope.

7. Find the value of

$$\int \sin^2 \theta d\theta, \int e^x x^2 dx, \int \frac{dx}{x^2 - a^2}, \text{ and } \int_0^1 \frac{dx}{1+x+x^2}.$$

8. Find the value of

$$\int \frac{(2x+1)dx}{x(x+1)(x+2)}, \int_0^a \frac{(a-x^2)dx}{\sqrt{2(a^2+x^2)}}, \text{ and } \int \cos^6 \theta d\theta.$$

9. Find the area of the loops of the curve $x^4 - ax^2y + 4ay^3 = 0$. Find the area between the curve $y^2(x^2 + a^2) = a^2x^2$, and its asymptotes.

10. Find the volume of the solid generated by the revolution of a cycloid about its base.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELEMENTARY PHYSICS.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, five hours.

1. What are the reasons for selecting mercury as the liquid used in the construction of thermometers?

2. A brass bar measures 1.8 metres at 10°C ., when measured by a steel tape; what will it measure by the same tape at 30°C .? Tape and bar are in both cases at the same temperature. Coefficient of expansion of brass, .000018; of steel, .000011.

3. A piece of glass of which the linear expansion from 0°C . to 100°C . is .0009, its length at 0°C . loses at 0° one gramme of its weight in a fluid in which it is weighed while at 100° it loses only .96 gramme. Find expansion of fluid from 0° to 100°C .

4. At what two temperatures does a given mass of water have the same volume. In correcting the height of a barometer for temperature, which coefficient of expansion do you use, and why?

5. State the laws of Boyle and Charles. Explain how they furnish the means of determining the volume, temperature, or pressure of a mass of gas when two of the quantities are given.

6. A substance weighs 450 grammes in the air at 15°C ., what is its weight in vacuo? A litre of dry air at 0°C . weighs 1.293 grammes; specific gravity of the substance 2.7 of the weights 7.8.

7. What influence does pressure have upon melting point of ice? Explain the phenomenon of regelation.

8. A tank 10 metres long and 4.2 metres broad is filled with water at 12°C ., to a depth of 1.65 metres. How much steam must be condensed in the water to raise it to 25° ? How much will its temperature then be lowered by 250 kilogrammes of ice?

9. Two plane mirrors, placed vertically, are inclined to each other at an angle of 120° ; a horizontal straight line is drawn from due mirror to the other, construct the images formed.

10. A reflecting telescope consists of a concave mirror, whose radius of curvature is 2 metres, and an eye-lens of 5 centimetres focal length; distance from mirror to lens 1.15 metres. What will be the size of the image of an object 1 metre high, placed 10 metres from the reflector?

11. A ray of light falls upon one face of a prism, making angle of incidence = 40° . Refracting angle of prism 60° . Index of refraction 1.55. What is the angle of emergence?

12. Describe the phenomena which are observed when a ray of white light passes through a prism. What is "angle of minimum deviation"? What is "angle of dispersion"?

CHEMISTRY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Find the numerical coefficients in the following reactions: $a \text{H}_4\text{NCl} + b \text{CaCO}_3 = w \text{CaCl}_2 + x \text{H}_2\text{NCO}_3 + 2 \text{H}_4\text{NCO}_2\text{N}_2 + y \text{H}_2\text{N} + z \text{H}_2\text{O}$.

2. Give the names of the following substances, and state the rules upon which the names are given: FeCl_2 , Fe_2Cl_6 , H , H_4N , NaPO_4 , H_2SO_4 , H_2SO_3 .

3. Write the formulæ and chemical names of the following substances: Arsenic, bleaching-powder, gun-cotton, oil of vitriol, aqua fortis.

4. Describe the manufacture of glycerine and nitro-glycerine.

5. Given the percentage composition of chloroform as follows: C 10.04, H 0.83, Cl 89.13; required the formula; knowing that a litre of the vapor under normal conditions weighs 5.3536 grammes.

6. Show the relationship between the members of the chlorine group.

7. By the aid of graphic formulæ, show the relation of picric acid to benzole, tracing each step in the formation.

8. State the source and modes of formation, and means of preventing the formation, of boiler-scale.

9. What two kinds of white paint are in general use? What is the composition of each? What are their relative advantages?

10. Give a description of at least two substances which are used as disinfectants, and show how they act.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

RHETORIC AND NAVAL HISTORY.

ANNUAL EXAMINATION.

JUNE 12, 1878.—*Time allowed, five hours.*

[Starred (*) questions are alternatives.]

I.—RHETORIC.

1. Name and explain the principal figures of speech.

2. Give the principal rules for the structure of the paragraph.

3. Give Blair's rules for unity.

II.—NAVAL HISTORY.

1. Give an account of the affair of the Chesapeake and Leopard.

2. Name the captains who successively commanded before Tripoli, and give a short account of the command of each.

3. Give an account of the battle of Lake Champlain, with clear plans of the showing position of ships, land, direction of wind, and progress of the engagement.

4. What were the chief points of importance in the battle between the *Sham* and the *Chesapeake*?

5. Give an account of Farragut's operations in the Mississippi in the first half of 1862.

5.* Name the men most distinguished in American naval history, and state the important event in the lives of the three who rendered most important service.

6. Explain the terms, line-of-battle ship, frigate, sloop of war, two-decker, rade, long gun. What class of ships now corresponds to the line-of-battle at the beginning of the century? to the frigate?

6.* Give a general account of the battle of the Nile. What led to the battle? the place fought, commanders, approximate force of fleets, results.

7. Give some account of the Confederate steamer *Sumter*.

7.* When did the ram cease to be used in naval warfare? When was it rendered obsolete? When was the torpedo first used effectively? What brought about these changes?

CONSTITUTION.

SEMI-ANNUAL EXAMINATION.

JANUARY 28, 1878.—Time allowed, five hours.

1. Define treaty, prorogation and dissolution, law and equity, original and appellate jurisdiction, presentment and indictment, stocks and bonds.

2. Describe the methods by which Congress exercises the power to borrow money, explaining the terms *five-twenties*, *ten-forties*, *seven-thirties*. Explain the Refunding Act of July, 1870. What are the advantages of the national bank currency?

3. Enumerate (1) the absolute prohibitions upon the States; (2) those subject to modification by Congress. To whom do the prohibitions in the bill of rights apply?

4. When was the Navy Department established? When was flogging in the Army abolished? What is the tenure of office in the Army and Navy? What powers do the militia belong to Congress? what to the States? What is the extent of the power of Congress over places ceded to the general government? (Give Constitutional clause.) What reservation is generally made by the States in these cases?

5. By whom are the following persons elected or appointed: 1. President. 2. Senators. 3. Judges of the Supreme Court. 4. Presidential Electors. 5. Representatives. 6. Deputy postmasters (under \$1,000). 7. President *pro tempore* of the Senate. 8. Senators filling vacancies in recess. 9. Officers filling vacancies during recess of Congress.

6. With whom rests the power to impeach? to try impeachments? to suspend officers in recess? to expel members of Congress? to remove disabilities from members formerly in rebellion? to grant pardons? to ratify amendments (two amendments)? to suspend the writ of habeas corpus? to originate revenue bills? to call for the records and papers? to regulate time, place, and manner of holding elections for Senators? to make treaties?

7. State the extent of the judicial power of the United States, specifying the cases in which the Supreme Court has original jurisdiction. How did the XIth amendment limit the judicial power? Compare the scope of Parliamentary power with that of Congress, and point out the corresponding difference in the judicial power in the United States and Great Britain.

8. Describe briefly the three cases in which laws have been declared unconstitutional. How does the question of the Constitutionality of a law arise in the courts?

9. Enumerate the rights of persons under criminal prosecution. Explain the difference between appeal and writ of error. How does the VIIth amendment limit the process of appeal?

10. What is the Constitutional provision as to the formation and government of new States and Territories? State the extent of the political and civil rights enjoyed by inhabitants of a Territory. Describe the usual form of Territorial government, and the process by which a Territory becomes a State.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE, 1878.—*Translate into French.*

DEPARTURE OF GIL BLAS FOR SALAMANCA.

Previous to my departure, I went to kiss my father and mother, who did not spare me remonstrances. They exhorted me to be grateful towards my uncle, to live as an honest man, and, above all, not to take the goods of others; and they gave me their benediction, which was the only thing that I expected from them. Immediately I mounted my mule, and went out of the town. Behold me then out of Oviedo, on my way to Pagnafior, master of my actions, a bad mule, forty ducats, and some reals. The first thing I did was to count and count again my ducats in my hat. I could not contain my joy: I had never seen so much money; I could not tire myself in looking at it and handling it. I was counting it perhaps for the twentieth time, when suddenly my mule stopped in the midst of the high road. I judged that something frightened him: I looked, and perceived on the ground a hat overturned; at the same time I heard a lamentable voice, which uttered these words: "Mr. traveller, have pity, I pray, on a poor lame soldier; throw, if you please, some pieces of money into this hat; you will be rewarded for it in the other world." I then turned my eyes on the side whence the voice came: I saw at the foot of a bush a kind of soldier, holding in his hand a musket with which he was taking aim at me. At this sight, which made me tremble, I stopped short: I promptly concealed my ducats, I threw some reals into the hat and had the precaution to throw them one after the other to show the soldier that I acted nobly; he was satisfied with my generosity, and gave me as many blessings as he gave kicks to my mule in order to get quickly away from him, but the cursed animal did not go faster for that: the long habit which he had contracted to walk step by step under my uncle, had made him lose the use of the gallop. I did not draw from this adventure too favorable an omen for my journey. I represented to myself that I was not yet at Salamanca, and that I might indeed meet with some worse accident.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1.

What are the duties of the officer of the fore-castle? What are the duties of the officer of the gun-deck? What are the duties of the officer of the deck?

2.

State how launches are fitted for weighing anchors. Weigh a bower anchor with a launch fitted with a funnel. Carry out a kedg for warping ship.

3.

Describe the log-line and time-glasses. How is the log-line marked? Describe the different kinds of leads used aboard ship. How are the different lead-lines

4.

Name the different day and night lookouts. State the numerals and symbols used in recording the wind, weather, clouds, &c., in the log-book. What are the signals used in coming ship?

5.

How are bower and sheet chains bent? How are bower and sheet anchors ready for use? How are bower anchors let go? Describe fittings. How do you secure an anchor? How do you know which end of a cable to bend to the anchor?

6.

Describe the manner of measuring for rigging with a fore-and-aft draft as a scale.

7.

How are yards secured for hoisting heavy weights? Make preparations aboard a steam launch. Give general rule for the lead of yard and stay falls. Re-secure and main braces, fore and main topsail braces, and cat-fall (give reasons for the cat-fall as directed).

8.

Describe by diagrams a main-topsail and a spanker. Describe the manner of letting fall, laying on oars, and how oars are held in the different positions.

9.

How do you make preparations for loosing sail to a bowline and how do you secure sails to a bowline? How do you furl sails which are loosed to a bowline?

10.

Give the rules of the road, including lights and fog-signals; use diagrams illustrating the different cases of the former.

NAVAL TACTICS.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, four hours.

1.

Draw a diagram of a fleet of twenty-four vessels, *in line, natural order*. Show by means of brackets how it is divided into divisions and squadrons, placing the number of each over its bracket. Show by whom commanded, by placing the number of order of rank to the right of the name of division or squadron. State positions of *commander-in-chief*, *division* and *squadron* commanders. Draw diagram of twelve vessels, *column, natural order*; show as above how divided, named, and commanded. State positions of *commander-in-chief*, and *division* commanders. State distance between vessels at *half distance*, in *close order*, and in *open order*.

2.

The fleet being in column of vessels, in natural order, heading north, form double column of vessels, abreast by divisions, heading N.E. $\frac{1}{2}$ N., in natural order. State fully how the courses are signalled.

3.

The fleet being in line, form column of divisions on the centre division, heading north. The fleet being in column of divisions, form line.

4.

he fleet being in columns of vessels abreast by divisions in *natural order*, heading th, form it into column of vessels on the right division, in *natural order*, preserving original direction.

5.

he fleet being in double column on the centre, heading north, form it into line to right or left, at right angles to the original direction (three methods).

6.

Draw diagrams of fleet in *double echelon*, in *natural*, in *reverse*, in *inverted*, and in *re-inverted* order. What is echelon in bow-and-quarter line, and how formed?

7.

he commander-in-chief signals: "From the vessel whose distinguishing pennant hewn above this signal, form *double-echelon*." N. B.—Distinguishing pennant of 13 shown. Re-form the line to the front.

8.

he fleet being in column of vessels by the wind and headed off, restore the order on same tack. The wind veers, restore the order on the same tack.

DEPARTMENT OF ORDNANCE AND GUNNERY.

INFANTRY TACTICS.

SEMI-ANNUAL EXAMINATION.

FEBRUARY, 1878.—*Time allowed, four hours.*

[Draw diagrams wherever it is necessary to complete the explanation of a movement.]

Describe the direct step; state how its principles are taught; describe the march direct step.

Give the position of "carry arms"; describe the execution of the following positions: "Order arms"; "carry arms"; "right-shoulder arms"; "support arms"; "carry arms"; "load in four times"; to "aim"; "right-oblique aim"; "fire kneeling"; "on guard"; "prime parry, thrust."

To form the company. After forming the company, post officers and non-commissioned officers, march in column of fours to the front.

Being in column of four, form line to the front; to the left; and on the left.

Skirmishers. Deploy a company to the front. Deploy by both flanks. A battalion of ten companies being in line at a halt, deploy forward on left of fifth company, & deployment by numbers.

Battalion being in line at a halt, advance in line; change direction in line; halt, & alignment. Fire by company. Fire by rank.

Being in column of fours, form front into line faced to the rear. A part of the column of fours having changed direction to the right, form line to the left. Being in line, form double column of fours.

Being in line at a halt, play the battalion into close column on the first division of the first division in front. Being in close column of divisions at a halt, deploy to the left on the first division. Column of divisions at full distance at a halt, & into column of companies.

Describe the review of a battalion, explaining all the movements in detail.

Tactical example. A battalion of ten companies, marching in double columns, is delayed by an obstruction. Attacked from the left and front. Left flank beaten back, requiring change of front. Explain the movements necessary to meet contingencies, giving diagrams.

GUNNERY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Name and define the different parts of the Dahlgren gun. Define calibre.
2. Material of cartridge-bags; define gravimetric density; how fill a charge? how enter it in the bore, and why?
3. Describe the preparation of a spherical shell for service, from leaving inspector's hands until ready for loading.
4. Describe "in-and-out" and "compression" gear of monitor carriages. What are sectional staves? where used, and why?
5. Describe Bormann fuse and how prepared for firing. How do you use shrapnel for canister when the latter is gone?
6. Define *shell*, *shrapnel*, and *canister*, and state the uses of each.
7. What is a *rifled gun*? Define *land*, *groove twist* (uniform and increasing), *drift*. What is the advantage of rifle over spherical projectiles? Directions of drift?
8. Describe a *trunnion square*. What is the use of the *star-gauge*?
9. Describe the sights of 8-in. rifle, 100-pdr. Parrott, and 12-pdr. smooth-bores.
10. Give directions for pointing a gun when the ship is motionless; also when moving rapidly ahead and rolling heavily.
11. Discuss appearance of vent impressions as indicating safety of gun. What is the regulation size of the vent? What is the greatest enlargement allowed?
12. Give the names of the different classes of naval powder (new classification); size of grains in each, and specific gravity of powder.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ASTRONOMY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

1. On the horizon of a place in latitude 30° N. project stereographically the different circles of the celestial sphere, so as to show the latitude, longitude, right ascension, declination, altitude, azimuth, and hour angle of a heavenly body whose right ascension is 9 hours, the sidereal time being 6 hours. (Draw the primitive circle with a radius of 3 inches.)
2. Explain the index error of a sextant, and give one method of obtaining it.
3. How would you construct a vernier—the arc reading to $8'$ —so as to read to $16''$?
4. A sextant has a negative I. C. of $12' 15''$, and an angle of $32^{\circ} 12' 15''$ is measured with it, what will be the sextant reading? Also through what arc will the zero of the vernier *actually be moved*, starting from the position of parallelism?
5. January 2, 1878 (civil day), the local apparent time being 6 a. m. in longitude $165^{\circ} 47' 15''$ east, find the hour angle of the moon?
6. Show how to obtain the parallax in altitude, the horizontal parallax being known. Show how the dip is affected by refraction. What will the magnitude of the dip, the refraction, and the parallax depend upon? (The state of the atmosphere being supposed to remain unchanged.) Give the signs of application to an observed altitude.
7. Describe the methods of the text of obtaining the latitude at sea.
8. Describe the methods of obtaining the longitude at sea. 1st, from Greenwich chronometer; 2d, from a corrected lunar distance.
9. Define the equation of time in terms of hour angle, and of longitude and right ascension. To what two causes is it due?

10. April 18, 1878 (astronomical day), longitude $122^{\circ} 43'$ west: the *true* altitude of γ being 17° , at *lower culmination*, what is the latitude?

11. Define the sidereal, tropical, and anomalistic years. State the causes of the differences in their lengths. Which is used in our calendar, and why?

12. Describe briefly precession and aberration.

13. Define the common, and the corrected establishments of a port; neap and spring tides. At which of the latter does the water fall the lowest? What is lagging and when does it occur?

14. Deduce, and explain by a diagram, formulæ for finding the sidereal period of a superior planet from the synodical. How is the latter found?

15. June 30, 1878 (civil day), north latitude, longitude east 120° , find the time of the lower high-water, the corrected establishment being $6^h 46^m$.

16. What is a nebula, and what a cluster? What is the annual parallax of a star? How are stars catalogued?

17. Define briefly a comet; a shooting star; a detonating meteor, and an aerolite. What are the minor planets, and where are their orbits?

18. How find the horizontal parallax of the moon and thence its magnitude? In what time does the moon rotate upon its axis?

19. October 6, 1878 (astronomical day), at Annapolis, longitude $5^h 05^m 56^s.5$ west, the local mean time being $4^h 30^m$, how long will it be until the star Altair (R. A. $19^h 44^m 53^s$) crosses the meridian?

20. December 25, 1878 (astronomical day), longitude $103^{\circ} 36'$ east, when Spica (R. A. $13^h 18^m 49^s.6$) is on the meridian, the sidereal clock shows $14^h 49^m 15^s$, what will be the local mean time when the clock shows 15^{hrs} , its rate during the interval being inappreciable?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY AND MAGNETISM.

ANNUAL EXAMINATION.

JUNE, 1876.—*Time allowed, five hours.*

1. Explain the distribution of charge upon a body under the influence of induction? Are the density and potential the same at all points?

2. Give an expression which will show the relation between the length, section, and material of a conductor and its electrical resistance. How does temperature influence the resistance of (1) a conductor, (2) a non-conductor, and (3) an electrolyte?

3. Explain the difference between the electro-static and electro-magnetic systems of units.

4. A magnet when freely suspended makes one vibration in 9.18 seconds: the same magnet when placed perpendicular to the meridian, with its centre at a distance of 2.2 feet from a suspended needle, deflects the latter through an angle of $1^{\circ} 18' 124$. What is the value of H , the horizontal intensity of the earth's magnetism? Moment of inertia of magnet, 0.12414.

5. Two small insulated metallic spheres are charged with quantities of electricity in the ratio of 3 to 5, and, when placed at a considerable distance from each other, they repel each other with a certain force. After being made to touch, they are separated to three times the first distance. Compare the force of repulsion which they now exert with that exerted in the first instance.

6. A fixed non-conducting ball is charged with positive electricity and acts by induction on a small metallic ball placed at a considerable distance and slightly charged, also, with positive electricity. When the distance between their centres is 10 c. m. the movable ball is in equilibrium. Taking its radius as 1 c. m., find, approxi-

mately, the ratio of the quantity of electricity developed by induction to the electricity originally on the ball.

7. A reflecting galvanometer whose resistance was 8,000 ohms, and which shunt reducing its sensibility a hundredfold, was joined up with a battery of 3 resistance and a standard resistance of 90 ohms, and the deflection was 72 scale divisions. Find the constant of the unshunted galvanometer; that is, the resistance circuit which would give a deflection of one scale division.

8. Twenty-four cells are to be used to work an electro-magnet. The resistance each cell is .304 ohm; resistance of magnet, .274 ohm; E. M. F. of each cell, $\frac{1}{10}$. How connect up battery?

9. A wire 2 metres long is moving with a velocity of 100 metres a second in a uniform magnetic field, perpendicularly to itself and the lines of force. What is the intensity of the field in order to develop an E. M. F. equal to one volt?

10. A submarine cable develops a fault. How is its position determined?

11. Draw diagrams showing instruments and connections at both stations of duplex systems of telegraphy.

12. A tangent galvanometer and voltameter are placed in the same circuit. The deflection is 41° ; oxygen and hydrogen liberated per minute 74.5 c. cm.^3 . If the galvanometer be included in a circuit with a saturated solution of Cu SO_4 , a deflection be 10° , how much copper will be deposited in 24 hours?

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

CALCULUS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—Time allowed, five hours.

[Nine questions required.]

1. Given $\frac{\phi(x)}{x} = \frac{\phi(z)}{z}$, and $\phi(e) = e$, to determine the function ϕ . Deduce the differential of $\log x$.

2. Given $y = \log \frac{(x-1)^2}{x^2 + x + 1} - \sqrt{3} \tan^{-1} \frac{2x+1}{\sqrt{3}}$, find $\frac{dy}{dx}$.

Given $y = \frac{e^x \sqrt{x^2-1}}{x + \sqrt{x^2-1}}$, find $\frac{dy}{dx}$.

3. Prove that of all circular sectors of the same perimeter, the sector of greatest area is that in which the circular arc is double the radius. Trace the curve $r = 2a \cos \theta$ and determine the maxima values of r .

4. If $x = \tan(x+y)$ expand y in powers of x to the term containing x^2 , inclusive. Expand $\log(1+e^x)$ in powers of x to the term containing x^2 inclusive.

5. Trace the curve $r = a \frac{2\theta}{2\theta-1}$; find the rectilinear and the circular asymptotes. Trace the curve $(y^2 - b^2)^2 = a^3 x$; find the points of inflexion.

6. Find the perpendicular from the origin on the tangent of the four-cusped cycloid. Find the subtangent and the point of inflexion of the lituus $r^2 \theta = a^3$.

7. Find the equation of the evolute to the tractrix

$$x = a \log \frac{a + \sqrt{a^2 - y^2}}{y} - \sqrt{a^2 - y^2}.$$

Find the radius of curvature of the lemniscata $r^2 = a^2 \cos 2\theta$.

8. Find $\int \sqrt{\sin \theta} \cos 3\theta d\theta$, $\int \frac{\cos x dx}{\sec x + \tan x}$, and $\int \frac{dx}{(x-1)^2 (x^2+1)^2}$.

9. Find the area of the loop of the curve $a^3y^2 = x^4(b+x)$; or find the whole area of the curve $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$. Find the length of an arc of the semi-cubical parabola $ay^2 = x^3$.

10. Find the volume generated by the revolution of the tractrix about the axis of x . Derive the formula for determining areas by means of Amsler's planimeter.

11. Find the evolute of the curve $\begin{cases} x = \frac{1}{2} \sin \theta - \sin^3 \theta, \\ y = -\frac{1}{2} \cos \theta + \cos^3 \theta. \end{cases}$
Trace the curve $2x^3 - 4x^2y + 2xy^2 - 6x^2 + 6y^2 + 15y = 0$.

MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, five hours.

1. A solid is formed by the revolution about the axis of X , of the curve $a^2y = ax^2 - x^3$; find the centre of gravity of the portion between the limits $x = a$ and $x = 0$. A right cone is divided into two equal parts by a plane containing the axis; find the co-ordinates of the centre of gravity of one of the parts.

2. Two small rings slide on a smooth vertical hoop; a cord passing through the rings sustains three equal weights, one on the bight between the rings, and one at each end; find the position of equilibrium.

Or—

2. A string, $A B C D E P$, is attached to the centre, A , of a pulley, the radius of which is r ; it then passes over a fixed point, B , and under the pulley, which it touches in the points C and D ; it afterwards passes over a fixed point, E , and has a weight, P , attached to its extremity; BE is horizontal and equal to $\frac{1}{2}r$, and DE is vertical: supposing the system to be in equilibrium, find the weight of the pulley and the distance, $A B$.

3. A uniform chain, l feet in length, hangs over two smooth pegs in the same horizontal plane $2a$ feet apart, the ends of the chain being in a horizontal line 2 feet below the lowest point of the bight; derive the equation to the curve of the bight, and prove that the tension at any point of this curve is equal to the tension at the lowest point plus the weight of a portion of the chain, whose length equals the ordinate at that point, the lowest point of the curve being the origin; find also the length of the part of the chain between the two pegs.

4. A weight, W , is held on a rough inclined plane by friction and a cord lying on the plane, the coefficient of friction being unity, and the breaking strain of the cord $\frac{W}{\sqrt{2}}$; determine the inclination of the plane when the cord is on the point of breaking.

Or—

4. A weight of 2,000 pounds is to be lowered into the hold of a ship by means of a rope which passes over a spar lashed across the hatch coamings; the arc of contact between the rope and spar being $1\frac{1}{2}$ circumferences, and the coefficient of friction $\frac{1}{2}$, determine the force which a man must exert at the end of the rope to control the weight.

5. Compare the work accumulated in a ship weighing 2,000 tons, and moving at a speed of $7\frac{1}{2}$ miles per hour, and that accumulated in a shot weighing 400 pounds, and moving with a velocity of 1,500 feet per second. A body is projected up a smooth inclined plane of height h ; when half way up the plane the force of gravity is doubled, and the body barely reaches the top of the plane; required, the velocity of projection.

6. A ball whose elasticity is e is projected from a given point in a circular hoop, and after two reflections returns to the given point; determine the direction of projection. A shot is fired with a velocity of 400 feet, at an elevation of 30° , and is observed to strike an object at the end of 4 seconds; find the inclination of the line which joins the object and the gun.

7. Find the radius of gyration of a right pyramid about its axis. Determine the ratio of the diameter of the base to the altitude of a cone, so that the centre of oscillation when the cone is suspended by the vertex may be at the centre of the base.

8. Find the horse-power of an engine that raises a tilt-hammer, weighing $1\frac{1}{2}$ tons, 25 times a minute, the lift being 2 feet. The number of vibrations made in a certain time by a pendulum at the surface of the sea was 20,000, and the number made in the same time by the same pendulum at a height of 10,530 feet was 19,930; find the radius of the earth.

9. A circle whose radius is a is immersed in a fluid; find the centre of fluid pressure. b denoting the distance of the centre of the circle below the surface of the fluid. A paraboloid of revolution, formed of solid oak, floats in water with its axis vertical and vertex downward; find the depth of flotation, the length of the axis being 3 feet, the radius of the base 2 feet, and the weight of a cubic foot of oak 54 pounds.

10. A vessel in the form of an ellipsoid of revolution is filled with fluid; find the time in which the fluid will flow out through a small orifice at the lower extremity of the axis of revolution, which is vertical and equal to $2a$. A cylindrical diving-bell 10 feet high is sunk until its top is 18 feet below the surface of the water; if the pressure of the atmosphere is 15.625 pounds to the square inch, find the height of the water in the bell.

Extra question.

11. Find the time of emptying a vessel formed by the revolution of a given cycloid about its axis, the orifice being at the vertex and the axis vertical.

An inclined plane, l feet in length, makes an angle of 30° with the inelastic horizontal plane on which it rests; two equal weights, connected by an inextensible cord passing over a pulley at the top of the plane, rest one at the top of the inclined plane, and the other on the horizontal plane vertically below it; the cord is of such a length that when the former is allowed to fall down the plane the impulse is just sufficient to permit it to reach the bottom; if the weights continue to oscillate, find the time before they come to rest.

DIFFERENTIAL AND INTEGRAL CALCULUS.

SEMI-ANNUAL EXAMINATION.

ELECTIVE COURSE.

JANUARY, 1878.—Time allowed, five hours.

Cadet-Midshipmen R. H. Miner, J. Hood, H. Wike, A. B. Clements, E. E. Hayden, and H. S. Chase.

Cadet-Engineers W. M. McFarland, R. Gatewood, F. T. Bowles, B. J. Bryan, and C. B. Lubbe.

$$\text{Given } \int_0^x \frac{x^{a-1} dx}{1+x} = \frac{\pi}{\sin a\pi} = \Gamma(a)\Gamma(1-a), \quad \int_0^x \frac{x^{a-1} dx}{1-x} = \pi \cot a\pi,$$

$$\text{and } \int_0^{\frac{\pi}{2}} \sin^{p-1}\theta \cos^{q-1}\theta d\theta = \frac{\Gamma\left(\frac{p}{2}\right)\Gamma\left(\frac{q}{2}\right)}{2\Gamma\left(\frac{p+q}{2}\right)},$$

$$1. \text{ Find the value of } \int \frac{1-x^2}{1+x^2} \cdot \frac{dx}{\sqrt{1+x^2}}, \text{ and of } \int \left(\frac{1-x}{1+x^2}\right)^2 dx.$$

$$2. \text{ Find the value of } \int_0^1 \frac{x^2 dx}{\sqrt{1-x^4}} \times \int_0^1 \frac{dx}{\sqrt{1+x^4}}, \text{ and of } \int_0^1 \frac{dx}{(1-x^4)^{\frac{1}{2}}},$$

3. Prove De Moivre's theorem, by means of $\int \frac{dx}{1-x^2}$ and $\int \frac{dx}{1+x^2}$. Find the value of $\int_0^{\infty} e^{-x^2} dx$.

4. Find the value of $\int_0^{\infty} \frac{x^a \log x dx}{1+x^2}$. Prove that $B(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$.

5. Find the value of $\Gamma\left(\frac{1}{n}\right) \Gamma\left(\frac{2}{n}\right) \dots \Gamma\left(\frac{n-1}{n}\right)$. Find the area enclosed between the two loops of the Limaçon, $r = 2a \cos \theta \pm a$.

6. Find the whole area of the curve $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$. Prove the formula, $\frac{1}{2} \int r^2 d\theta = \frac{1}{2} \int x^2 dm$, and thence derive an expression in gamma-functions for the area of the loop of the curve, $x^3 + y^3 - 5ax^2y = 0$.

7. Find the length of the curve of double curvature

$$y = \frac{a}{2} \left(e^{\frac{x}{a}} + e^{-\frac{x}{a}} \right), \quad z = \frac{1}{8} \left[y \left(e^{\frac{x}{a}} - e^{-\frac{x}{a}} \right) - 2x \right].$$

8. Find approximately, by means of gamma-functions, the length of a loop of the curve $r^{\frac{1}{3}} = a^{\frac{1}{3}} \cos \frac{1}{3}\theta$. Find the length of the curve, $x = 4 \sin \phi - \sin^3 \phi$ and $y = \cos \phi + \cos^3 \phi$, between the limits $\phi = 0$ and $\phi = \frac{\pi}{2}$.

9. The axis of a right cylinder whose base is the curve $r = a \cos 3\theta$ passes through the centre of a sphere of radius a ; find the volume enclosed between the convex surface of the cylinder and the concave surface of the sphere. Find a general expression for the volume generated by the revolution of a circular segment about its chord.

10. Trace the curve $y = \frac{x(1-3e^{\frac{1}{x}})}{1+ex}$, also the curve $y = xe^{-\frac{\sin a}{2}\left(\frac{1}{x}\right)}$, finding the maximum and minimum ordinates.

11. The axis of a right cone coincides with the generating line of a cylinder; the diameter of both cone and cylinder is equal to the common altitude: find the volume and surface of each of the parts into which the cone is divided by the cylinder.

ELECTIVE MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, five hours.

Cadet-Midshipmen R. H. Miner, A. B. Clements, J. Hood, E. E. Hayden, H. Wike, H. S. Chase, J. B. Blish, and C. W. Jungen.

Cadet-Engineers W. M. McFarland, F. T. Bowles, R. Gatewood, and B. J. Bryan.

1. A paraboloid of revolution (altitude a) rests on a horizontal plane; determine its position of equilibrium, the generating curve being $y^2 = 4mx$. Find the value of m in terms of a when the solid rests in stable equilibrium on its apex.

2. A cord suspended from two given points has the area of its transverse section proportional to the tension at every point; find the equation to the curve in which it hangs. A perfectly flexible smooth cord hangs over a horizontal peg; find the time required for it to slide off, supposing the centre of the cord to rest on the peg when it receives an impulse giving it an initial velocity of 32 feet per second.

3. A body is situated at the distance a from the centre of an attractive force which varies inversely as the nine-elevenths power of the distance; find the time required for the body to fall to the centre of force. Find the time when the force varies inversely as the distance.

4. The resistance of air being proportional to the square of the velocity, determine the time required for a body projected vertically upward to return to the point of starting; determine also the velocity at any point.

5. A particle is placed on the concave surface of a smooth sphere and acted upon by gravity, and also by a repulsive force which varies inversely as the square of the distance, and has its centre at the lowest point of the sphere; find the position of equilibrium of the particle.

6. Find the relation between the moments of inertia of a plane surface with reference to two different pairs of rectangular axes, the origin being the same. Find the polar moment of inertia of a regular hexagon.

7. A particle is projected from a given point in a given direction with a given velocity, and moves under the action of a force which varies inversely as the square of the distance from the centre; required, the orbit. If the force varies directly as the distance and is attractive, determine the orbit.

8. A particle is placed in a smooth tube which revolves horizontally about an axis through one end of it; required, the equation of the curve traced by the particle. A homogeneous prismatic bar AB in a horizontal position, and constrained to revolve about a fixed vertical axis A , receives a direct impulse from a sphere whose momentum is Me ; required, the angular velocity of the bar.

9. A sphere C of radius 3 feet and weight 500 pounds is put in motion by a weight P of 20 pounds by means of a string going over a wheel whose radius is 6 inches; in what time will P descend through 50 feet, and what velocity will it then have acquired? A homogeneous hollow cylinder rolls down an inclined plane by the force of gravity; required, the time.

10. A paraboloid whose weight W is 200 pounds and radius of base 20 inches is made to revolve about its axis, which is horizontal, by means of a weight P of 15 pounds, acting by a cord that passes over a wheel of one foot diameter on the same axis; after P has descended for 10 seconds it is removed and the paraboloid is left to revolve uniformly with the velocity acquired; find the velocity of the centre of gyration of the paraboloid and the number of revolutions it will make in one minute.

Regarding the earth as a homogeneous sphere, determine the momentum and the point of application of a blow sufficient to give it the angular velocity and velocity in its orbit it now has.

DEPARTMENT OF MODERN LANGUAGES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Translate into Spanish.*

HÉROÏSME.

Un capitaine hollandais, nommé Schaffelar, occupait la forteresse de Barneveldt. On l'assiégea et on le somma de se rendre, mais il ne voulut capituler que lorsque la brèche fut faite.

Le premier article de la capitulation exigeait que le capitaine fut jeté du haut de la tour. Cette condition excita l'indignation des assiégés, qui jurèrent tous de mourir avant qu'ils ne consentissent à une telle demande. Mais le généreux Schaffelar grimpa à la position indiquée et dit: "Mes amis, il faut que je meure un jour et je n'aurai jamais une occasion de mourir plus glorieusement, parceque je salue mes camarades par ma mort."

Ayant dit ces mots, il se précipita du haut de la tour.

FIRST CLASS.**DEPARTMENT OF SEAMANSHIP.****PRACTICAL SEAMANSHIP.****ANNUAL EXAMINATION.***JUNE, 1878.—Time allowed, five hours.*

1.

Your ship (sailing) having been in port a month, get her ready for sea in all respects.

2.

Tide rode, with wind two points on the starboard bow, get underway. Cast to starboard and stand out on a wind.

3.

How handle boats in a surf, going to and returning from the shore, under oars or sails? How land on a flat beach? How land on a steep-to beach? Where are weights carried in boats? How take people from a stranded wreck?

4.

Make preparations for a gale at sea. How is a close-reefed topsail set (blowing hard)? How take in a mainsail (fresh breeze)? How hoist a jib (fresh breeze)? How set a main-trysail (blowing hard)?

5.

Weather main topsail sheet and clewline carried away. What is to be done? On a wind, main topmast stay carried away. What is to be done? Weather wheel-rope carried away. What is to be done?

6.

Make preparations for entering port on striking soundings. By the wind, all plain sail set, get a cast of the lead in about thirty fathoms of water.

7.

Your ship (sailing) entering port, moor ship in seven fathoms of water with forty-five fathoms on each chain; prevailing wind from the north.

8.

Ship moored in a tide-way, with an elbow in the hawse. Make preparations and clear hawse. State how the mooring swivel is put on.

9.

What are the boat salutes of all grades of officers, both under oars and sails and when boats are loaded?

10.

What are the indications of a cyclone? Give the geographical limits in both the Atlantic and Indian Oceans and the seasons of cyclones in each. How manœuvre in a cyclone in the Northern Hemisphere? How in the Southern?

NAVAL ARCHITECTURE.**SEMI-ANNUAL EXAMINATION.***FEBRUARY 1, 1878.—Time allowed, five hours.*

1.

Define meta-centre, and distinguish between the fixed and shifting meta-centre. Deduce the formula for transverse meta-centre height. How find the point of intersection of the upright and inclined water-lines?

2.

Define statical stability. Deduce the formula for statical stability, and explain the terms of the second member of the equation. Show what effect a change in the posi-

tion of the centre of gravity of the ship has upon the statical stability. Define dynamical stability. Deduce the formula for dynamical stability, and explain the terms of the second member of the equation.

3.

Construct and fully explain a curve of stability. This includes wind curve, safe angle of heel, rolling limits, &c.

4.

Deduce the formula for time of ship's unresisted rolling and discuss the formula, showing how it is modified by the conditions encountered by a ship rolling in sea waves. State how rolling may be controlled to some extent by stowage. Distinguish between a stiff ship and a steady one. Give best conditions for a steady gun-platform.

5.

Design.—What constitutes design? What considerations govern design? What are the qualities to be sought for in a design? What is the quality of "working well" in a vessel propelled by sail? In one propelled by steam? Define the terms "entrance," "run," "middle body".

6.

Discuss the advantages of the "wave-line theory of construction." State the principles upon which the theory rests. What decides the length of entrance? of run? What governs the length of middle body? How are water-lines for "entrance" constructed? How are water-lines for "run" constructed? Name, place, construct, and give value of other lines governing form of after-body.

7.

Resistance to ship's motion through the water? Resistance due to frictional eddies? Define augmented surface, and show how it is computed. How compute probable resistance? How compute engine power for given speed? How compute probable speed with given power? Define coefficient of propulsion.

SHIP BUILDING.

SEMI-ANNUAL EXAMINATION.

JANUARY 29, 1878.—*Time allowed, five hours.*

WOODEN SHIP BUILDING.

1.

Give the order in which the work performed in building a ship is executed; the order in which the different timbers composing a ship are put together. (Explanation of the manner of doing the work is not required.) What is a "room and space" hatch? When and how used? What is a cutting-down staff?

2.

Make a sketch of a transverse section, showing all timbers cut by the midship section. State when the thick strakes of the outside and inside planking are worked, and explain the method of working them. When frames are first erected how are they retained in position? What are "ribbons," and when are they erected?

3.

Build the midship frame of a vessel; name the different parts composing it—1st, when long and short arm floor timbers are used; 2d, when first futtocks are used; explain how the different parts of the frame are secured together. Erect and regulate a midship frame; how is it marked?

4.

For what purpose is the main keelson worked? What fastenings are driven through it? When sister keelsons are worked, where do they terminate, and how are they fastened? What are filling timbers or frames, and how are they worked?

5.

Name all the different timbers that are worked to prevent the two sides of the vessel being forced together or forced apart, and state when each is worked. What is the throating line? Bearding line? Cutting-down line?

6.

How would you measure for the length of a gun-deck beam? Describe fully how the beam is secured in position. What is the shape of a beam, and why is it of this shape?

7.

At what point in the construction of a ship is she regulated? When may a ship be said to be regulated? What are chocks, and how are they worked?

IRON SHIP BUILDING.

8.

Name and describe the different systems of framing used in iron ship building. What kind of keel is in general use with each system? Describe the *bar* keel, and state how it is connected to the remainder of the hull.

9.

Describe the method of working keels and keelsons of an iron-clad man-of-war. Show how the garboard strakes are united to the keel. What care is to be taken in working these different parts of the ship?

10.

Make a sketch of the stem of an armor-clad vessel, and describe it. When in two or more parts, show how the parts are united, and how the stem is joined to the keel.

11.

How are the frames behind the armor spaced, and how worked? How work platings, girders, and backing behind armor? How work armor and armor-shelf? Describe armor bolts, and the method of testing them.

12.

What are "sheer strakes," and describe how worked? What are "deck stringers," and how are they worked? What are "hold stringers," and how are they worked?

13.

Make a sketch showing the different methods of working outside plating, and describe each method. Make a sketch showing the different systems of riveting. What is the "pitch" of rivets for water-tight work? in the frames? in other work?

14.

How frame and work a water-tight transverse bulkhead? How are "liners" to be worked at water-tight bulkheads?

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE AND ARMOR.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. What metals and alloys are in common use for making cannon? Give general qualities of each, stating how they affect fitness for making cannon.

2. Name and describe the two general principles upon which *built-up* guns are constructed, and give an example of each.

3. Give arguments for and against breech and muzzle loading guns for naval use.

4. Describe (in general terms) the breech-loading system adopted in the United States Navy.

5. Describe in detail the 8-inch (converted) rifle-gun now issued to the service (not the process of manufacture, but the gun itself as it stands).

6. Describe the action of the locks in the Gatling gun.

7. Define "system of rifling." Name the systems actually in use in the United States Navy, and describe the application of each system to existing service projectiles.

8. Define *gunpowder*. Give names and proportions of constituents, use of each constituent, and effect of varying proportions. The ingredients being prepared, name in their order the successive steps in the manufacture of gunpowder, stating briefly the object of each, but not entering into the details of the processes.

9. Describe the phenomena of explosion; effect of size of grains upon strength. Define *density*; effect of variations of density. How best obtain uniform density in powders issued to the service.

10. Give general directions for preparing and executing a landing in the face of an enemy.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

[Ten solutions required.]

1. Sketch and describe the Mayer valve.

2. Given one pound of carbon, thermal value 14,500, what will be the maximum temperatures of the furnace when burned with 12, 18, and 24 pounds of air.

3. Given one pound of good coal, liberating by its combustion 14,500 units of heat, which is done with 25 pounds of air; Required the heat available for the generation of steam, the furnace gases being discharged at 600° Fah., temperature of air 60° Fah.

4. Required the number of pounds of water evaporated per pound of coal per hour from the following data, viz: Diameter of piston 40", stroke 3', clearance 12 per cent of space displacement, steam pressure per gauge 35 pounds, cut-off at $\frac{1}{4}$ stroke, revolutions per minute 50, coal consumed per hour 1,500 pounds. Relative volume of steam 1,530, temperature of steam 283.2° Fah., temperature of feed-water 110° Fah., density of feed $\frac{1}{4}$, density maintained 2.

5. Compute the total horse-power from the following data, viz: Mean effective pressure 30 pounds, vacuum 26 inches, stroke 5 feet, diameter 50 inches, number of revolutions per minute 100, ratio of expansion 2. ($\log_e 2 = 0.693$) Give the initial pressure per gauge.

6. Sketch a locomotive slide-valve. Mark upon it the points at which the several functions are performed, naming them. Illustrate its action by a diagram upon which the above points are designated.

7. Sketch and describe a Bourdon pressure gauge, a mercury syphon gauge.

8. Describe a compound engine; state the advantages and disadvantages of joining, first, the H. P. cylinder; second, the L. P. cylinder; third, both cylinders.

9. Required the diameters of both the H. P. and L. P. cylinders of a compound engine, from the following data, viz: Indicated H. P. 500, mean effective pressure 30 pounds, length of stroke 3 feet, number of revolutions per minute 60, ratio of expansion 9.

10. Explain the method of combining indicator diagrams of compound engines, and of drawing in the theoretical expansion curve for scientific investigation.

11. How are the moving parts of an engine counterbalanced?

DEPARTMENT OF ASTRONOMY AND NAVIGATION.
NAVIGATION.

SEMI-ANNUAL EXAMINATIONS.

JANUARY, 1878.—*Time allowed, five hours.*

[Questions marked thus * are required.]

1. * What application is made of the problems of plane, parallel, traverse, and middle latitude sailing, in an ordinary day's work or dead reckoning at sea?
2. * How is the Mercator's course between two positions found by inspection? How thence is the distance found?
3. Deduce the formulæ for finding the Great Circle course and distance between two positions.
4. How will you determine the advisability of pursuing the Great Circle route between two places?
5. * Define refraction, dip, and parallax. Illustrate by diagrams and give the sign of application of each to an observed altitude.
6. * How is the parallax in altitude found, the horizontal parallax being known?
7. * Give one method complete for the conversion of local sidereal time to local mean time.
8. Solve the astronomical triangle for h and Z , given t , d , and L .
9. Given L and d , how is the actual time of sunset and sunrise found? (Disappearance of the sun's upper limb below the horizon.)
10. * Deduce the formulæ for finding the latitude by an altitude at any time (ϕ' , ϕ'' method).
11. What are ϕ' and ϕ'' respectively? How are they marked? and why?
12. A meridian altitude of the sun not being attainable, how may the latitude be found by an altitude out of the meridian by some other method than that given in (10)? Deduce the formulæ.
13. * Deduce the equation of equal altitudes.
14. * Apply this to finding the chronometer correction; give the details of the various steps, with the reason therefor.
15. What is a circle of equal altitude? Illustrate by a figure. What is a line of position?
16. Give the method of determining the position of a vessel at sea by means of two lines of position, the observations being taken at different times, and the ship not being stationary.
17. What determines the angle between the two lines of position? What would be the most favorable condition that could be selected to obtain the absolute position of a ship at any given instant?
18. For what purposes are lunars useful? How much reliance can be placed upon them? In the direct trigonometrical method, what quantities are required? How are they obtained? Draw a figure explaining the different points of the triangle.
19. How is a Mercator's chart constructed? How are the course and distance between two points on the chart obtained?
20. Deduce the expression for the change in t due to a change in h , and apply this to finding L (Prestel's method).

EXTRAS AND ALTERNATES.

1. Deduce the formula for the meridional parts of the spheroid, having given—

$$r = \frac{a \cos L}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}}, \quad R = \frac{a (1 - e^2)}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}}.$$

2. Deduce the expression for the change in L due to a change in d .
3. Deduce the expression for the change in L due to a change in t .

4. Deduce the formulæ for obtaining the astronomical bearing of a terrestrial object, the angle being measured with a sextant.

5. Deduce the formulæ of Bowditch's first method for finding the latitude by two altitudes of a heavenly body.

THEORY AND PRACTICE OF NAVIGATION AND SURVEYING.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. How are the levels of a theodolite adjusted? How is the axis of collimation caused to coincide with the line of sight and to move in a vertical plane?

2. In the construction of a chart of a harbor, how is a scale of $\cos^2 \delta$ made? How are the principal stations plotted? How is the shore-line run in? How are the soundings plotted?

3. Give the method of constructing a Mercator's chart. [Latitude 55° to 60° N.; the space between limiting parallels to be 15 inches; and the chart to include 6° of longitude.] Give the method of constructing a polyconic chart. [Scale $\cos^2 \delta$; to include 6° of longitude and the same latitudes as above.]

4. To what plane are all soundings reduced? How is the position of this plane determined? What is a bench mark? What is its use? How is it connected with the plane of reference?

5. In the running survey, what is the final base line? When the position by triangulation does not coincide with that by observation, how is it corrected? Explain this by a diagram. What is the most accurate method of fixing the ship's position, and thence the location of new points as they come in sight?

6. What is the variation of the compass? What is the deviation? How are they named? How are they applied, first, to compass courses, second, to true courses?

7. How is a deviation table formed? [State all the methods you know, except that of co-efficients.] How is a Napier's curve constructed, and how is it used?

8. What are the different causes of the deviation of the compass in an iron ship? How is the deviation table constructed by the method of coefficients, knowing the deviation on the eight principal points. How is this deviation table corrected practically for a change in the magnetic latitude?

9. Which two coefficients change with a change of the magnetic latitude? Explain how the two causes of this change have varying effects. How is a compass compensated?

10. What is the heeling error, and how is it caused? What is the heeling coefficient, and how does it vary with a change of the magnetic latitude? How is the change in deviation owing to the heeling error found for any point of the compass? How is a compass compensated for the heeling error?

PRACTICAL WORK.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

The cadets reported at the observatory at 8 a. m., and took altitudes of the sun, with the sextant and the artificial horizon for a chronometer correction, at the same time taking bearings of the sun with an azimuth compass which had been deflected by a magnet, for the compass error.

Immediately afterward they took an astronomical bearing of the chimney of a house on the north side of the Severn, the observers standing in a line near the observatory. Each cadet was then required to work out his own observations.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT AND LIGHT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1878.—*Time allowed, five hours.*

1. The length of a rod measured by a brass standard yard at 75° Fah. is 32 inches. What will be its length in millimetres when measured by a platinum standard metre at same temperature, the coefficient of expansion of brass being 0.000018 for 1° C. and that of platinum 0.000009?

2. Describe the observations and indicate the computations necessary for determining the specific gravity of a vapor by Dumas's method.

3. What will be the weight of five litres of moist air at 20° C., barometer 750 millimetres, where the relative humidity is .35? Tension of saturated aqueous vapor at 20° C. is 17.4 millimetres.

4. Explain the different methods of measuring quantities of heat.

5. Ten grammes of molten tin at 245° C. are thrown into 20 grammes of water at 20° C. and raise the temperature of the water to 33° 8 C. Specific heat of tin as solid, .056; as liquid, .064; melting point, 233° C. Determine latent heat of tin.

6. What are the distinctive characteristics of the spectra of solids and vapors? What relation exists between the radiating and absorbing powers of vapors, and how does this explain the presence of dark lines in the solar spectrum?

7. Determine the mechanical equivalent of heat by the method of Mayer? How was Mayer's reasoning perfected by Joule?

8. State the theory of "Conservation of Energy," and that of "Dissipation of Energy." Give the evidence in favor of each.

9. Deduce the probable form of Carnot's function. Show that 0° of absolute scale is the lowest possible temperature.

10. Deduce the expression for the velocity of sound in air. $V^2 = \gamma E_\theta v$.

11. (Extra.) Deduce Apjohn's formula $f'' = f' - \frac{d}{87} \times \frac{h}{30}$.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.

ANNUAL EXAMINATION.

JUNE 7, 1878.—*Time allowed, five hours.*

1. Explain the difference between a domiciled foreigner and a naturalized foreigner. What facts constitute domicile? State the chief rules for determining domicile.

2. Describe the privileges or immunities of ambassadors, (1) as to their own persons; (2) as to the persons of others; (3) as to their houses; (4) as to their general jurisdiction; (5) as to their criminal jurisdiction.

3. In the case of an internal war or rebellion, what two courses may be followed by the government in its treatment of the insurgents, and how is each policy to be enforced? How are neutrals affected by the attitude of the government of the state in which the revolt occurs, and what rules govern their conduct?

4. State and define the points involved in the case of the Alabama, and give a brief history of the settlement of the question.

5. Define contraband, as understood by the best authorities. What is the penalty of engaging in contraband trade? What is pre-emption, and how is the practice applied? Give a comprehensive statement in regard to the carrying of enemy's dispatches.

6. What is a blockade by notification? What a *de facto* blockade? In what does due notice of a blockade consist? At the beginning of a blockade, how are neutral vessels lading in the enemy's ports affected? Give the four rules of the treaty of Paris of 1856, and define the position taken by the United States in regard to them.

7. Define *jus postliminii*. What is the limit of place within which this right takes effect? What is the limit of time? What is the practice of nations in regard to the admission of belligerent cruisers into neutral ports? Of cruisers with their prizes? If a prize is taken in neutral waters, where may the owner seek redress?

8. War between the United States and France. In command of the United States steamship *Hartford*, cruising in the Atlantic, you capture the bark *Murillo*, bound from Barcelona to Brest, with a cargo consisting largely of contraband of war. You send her into port and she is condemned on that ground. She was originally an American vessel, but was captured early in the war, condemned, and sold to a Spanish firm. The original owner puts in a claim. How will it be decided?

Next day you fall in with the *Caledonia*, an English vessel, bound for Brest, with some eighty men, French officers and seamen, the crew of a French gunboat; the contract was concealed or destroyed, but the vessel has no cargo, and was to have been paid by the French Government; you send her into port. Results?

Soon after, the *Alert*, an English vessel, bound from Malta to Portsmouth, England, is captured on the 4th of April by the blockading squadron off Bordeaux, while trying to enter that port; the master says that he was short of water and that the crew insisted on entering a French port. It is shown that he passed Lisbon, an open port, on the 2d of April, and neglected to enter, and that he knew Bordeaux was blockaded. Results?

9. A few days later you chase a French privateer, and capture her at the entrance of the harbor of Vigo, a Spanish port. What results will flow from your action? Steering to the northward, you meet the *Columbia*, an American vessel, bound to New York, in ballast, under a license from the French Government. She had sailed for Havre before the war, and there took on board a cargo of silk and oil for Stockholm. There she received news of the war, and sailed to Cherbourg with a cargo of naval stores. What will you do, and what will be the result? Entering the English Channel, you meet a fleet of Swedish merchantmen under convoy of a Swedish man-of-war of force superior to the *Hartford*; the man-of-war threatens resistance if search is made. During the night you succeed in detaching a couple of the merchantmen and send them into port. What will be the result as to vessels and cargo?

10. You are ordered to cruise in southern waters, and on your way you meet the *Venus*, bound from Martinique to France, with a cargo of sugar, the produce of an estate in the island. The owners are citizens of England, and they claim the cargo on the ground that it is neutral property, the owners of the estate being Englishmen. Results? Later on, you capture the *Diligentia*, bound from Rio to Bordeaux with a cargo of coffee, the property of J. & J. W. Madrazo, of New Orleans and Rio. One member of the firm is a domiciled American, the other a native Brazilian. The vessel is owned in Rio. What will be the result as to vessel and cargo? While cruising in the South Atlantic, a treaty of peace made; but thirty days are allowed from the date of ratification, July 1, for captures made in that part of the world. You capture the *Louis* on the 10th of July, and send her home for adjudication. She is recaptured on the 5th of August by a French man-of-war. Results?

DEPARTMENT OF MODERN LANGUAGES.

ANNUAL EXAMINATION.

SPANISH.

JUNE, 1878.—*Translate into English.*

Señores CADETES DE LA CLASE PRIMERA: Vuestro estudio en la Academia ha concluido, y el práctico de vuestra profesion va á comenzar. En el espacio de dos años, durante los cuales visitaréis diferentes paises, surcaréis mares diversos, y combatareis contra poderosos elementos, vuestro jóven corazon se verá agitado por opuestas emociones: hoy los placeres de la novedad; mañana la fatiga moral que la disciplina exige: un día el terror que inspira la furia de los elementos, otro el entusiasmo por el triunfo de la ciencia sobre su fuerza; y otro, en fin, el desaliento, y el tédio quizas al ver vuestra actividad encerrada en el casco de un buque. Vuestros instructores, previendo esos naturales contrastes, desean animaros con algunas reflexiones. Fijad en vuestro espíritu lo noble de vuestra mision, y la estension de conocimientos que la profesion abraza; y esta doble idea os dará aliento para resistir la fatiga, y disipar el tedio. La defensa del débil, del comercio, de vuestras envidiadas instituciones políticas, y de la dignidad nacional, son objetos bien dignos de esfuerzo para un oficial de elevados sentimientos. El estudio de las leyes que gobiernan las corrientes oceánicas, y fijan la marcha de los huracanes; el de la influencia que en ellos ejercen varios agentes químicos, y los cuerpos celestes; el modo de fijar los escollos que puedan presentarse en los mares y rios; el estudio de las ramificaciones de estos entre sí para establecer por ellas nuevas vías de comunicacion, ó acortar las ya conocidas en beneficio del comercio y de la humanidad; estos y otros objetos que forman el estudio del marino del siglo 19, ofrecen un ancho campo á vuestra actividad intelectual. “¿Creeis que los trastornos atmosféricos (escribe elocuentemente un oficial de la marina española) son para el marino contrariedades del momento, y que su cuidado debe limitarse á escapar del peligro diciendo: “ya esto pasó, hasta otro que venga cuando, y como le plazca? No, él debe interrogar á los huracanes, pedirles razon y cuenta de cuantos fenómenos envuelve, y este interrogatorio archivado con otros de igual naturaleza, debe servirle para compararlos, y deducir exactas tesis meteorológicas.” Sí, queridos amigos, vuestra profesion protectora y científica á la vez, es no solo necesaria en tiempo de guerra, sino progresiva y benéfica en tiempo de paz. Concentrad vuestra atencion en algunas de sus ramas (la que mas os guste): conviene que el hombre tenga *un fin* de su agrado, porque todas las ciencias estan entrelazadas, y de este modo estudia sin tédio todo lo que contribuye á ese fin. En cuanto á los lenguajes, leed los periódicos, id al teatro, y tratad de hablar en todas ocasiones. Los lenguajes dan una idea muy favorable de quien los posee, y en tiempos de peligro veréis la verdad de la proposicion que dice: “el hombre que conoce dos lenguajes vale por dos hombres.” Pero acabemos ya, porque necesitais descanso, y vuestra conducta durante el año os hace bien merecedores de él. Vuestros instructores se asocian al placer que vais á sentir y dar, mañana, á vuestras familias, y amigos; y al deciros a Dios! os desean salud y buen suceso en la carrera que se abre ante vosotros.

El Gefé del Departamento, y los instructores en el ramo de Español.

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. If, in a binary vapor-engine, the steam exhausts at a pressure of 10 pounds per square inch per gauge through the tubes of a receiver containing bisulphide of carbon, what is the maximum pressure that can be obtained in the receiver?

Barometer, 30".

	A	Log B	Log C	$\frac{B}{2c}$	$\frac{B^2}{4c^2}$
For water.....	8.2591	3.43642	5.59873	0.003441	0.0001184
For bis. carb.....	7.3438	3.30728	5.21839	0.006136	0.0000376

2. Compute the efficiencies of a square foot of the crown-sheet of a furnace, when the fuel (considered pure carbon) is burned with 18 and 24 pounds of air, the water being evaporated at a temperature of 250° Fah.

3. Given boilers of 200 square feet grate surface, burning 15 pounds coal (C, 0.915, H, 0.035, O, 0.026) per square foot per hour. Required the number of cubic feet of air necessary. Deduce the formula (weight of one cubic foot of air 0.0807).

4. The efficiency of the boilers in the last question being 55 per centum, for how many horse power would they furnish steam at 35 pounds per gauge, supposing each H. P. to require 285 pounds of steam per hour, temperature of feed-water 110° Fah.

5. The boilers of question 3 have horizontal fire-tubes discharging into a common back connection at base of smoke-pipe. There are 744 tubes 10' 6" long and 2½" internal diameter. There is supplied 300 cubic feet of air at 60° Fah. per pound of fuel. Compute the height of the smoke-pipe.

6. Sketch and describe an Ericsson's air-engine and draw the theoretical diagram. Explain why the efficiency differs from that of the steam-engine. Why is it not adapted to marine purposes?

7. Supposing the cylinder to be non-conducting, what is the H. P. from the following data, viz: Internal pressure per gauge 30 pounds; vacuum, per gauge 26 inches; barometer 30 inches; cut-off $\frac{3}{4}$; diameter of cylinders 36"; number of cylinders 2; length of stroke 3'; revolutions per minute 65. (Take the weight of one cubic inch of mercury .5 pound.)

8. Define isothermal and adiabatic lines and show under what circumstances they occur in diagrams of energy. Prove that the mechanical equivalent of heat absorbed or given out by a body in passing from a given state as to pressure and volume to another state as to pressure and volume, through a series of states represented by the co-ordinates of a curve on a diagram of energy, is represented by the area included between the given curve and two curves of no transmission drawn from its extremities and indefinitely prolonged.

9. Why is high-pressure steam more economical than low-pressure steam? What is a steam-jacket? State the relative advantages of jacketing the different cylinders of a compound engine. Define superheated steam. How many degrees of superheating produces steam gas?

10. State the second law of thermodynamics; deduce the general expression for the thermodynamic function of a substance.

DESIGNING MACHINERY.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, five hours.*

1. Give I. H. P. from following data: Length of vessel on water-line, 250 feet; mean immersed girth, 35 feet; mean of squares of sines of greatest obliquity, .025; mean of fourth powers of sines, .0008; coefficient of propulsion, 20,000; speed, 15 knots of 6086 feet.

2. Give the diameter of cylinder from the following data: Two equal cylinders, non-compound; indicated horse-power, 1,700; pressure, per gauge, 40 pounds; revolutions per minute, 60; stroke of piston, 4 feet; clearance, $8\frac{1}{2}$ per cent. of stroke-displacement of piston; cut-off, $28\frac{1}{2}$ from beginning; vacuum, 26 inches; barometer, 30 inches. Neglect compression.

3. Give diameter of crank-shaft, of iron, for a pair of engines, from the following data; resistance to torsion only to be provided for: Diameter of piston, 60 inches; stroke, 48 inches; pressure, per gauge, 40 pounds; factor of safety, 8. State the practice approved by the Bureau of Steam-Engineering in regard to length of shaft-journals.

4. Give the diameter of after crank-pin from the data of question 2; length, 20 inches; material, wrought iron; factor of safety, 8.

5. Give diameter of neck of connecting-rod from the data of question 3; length, 80 inches; material, wrought iron; factor of safety, 8.

6. Give steam-lap and lead, exhaust-lap and lead, and travel of valve, from the following data: $S=48$ inches; width of steam-port, 4 inches; cut-off, 36 inches from beginning; steam-valve opens when piston is $\frac{1}{2}$ inch from end of stroke; exhaust-valve closes when piston is 38 inches from beginning of stroke. Scale of crank-circle, $1\frac{1}{2}''=1$ foot.

7. Design a Meyer expansion-valve in conformity to the following data: $S=36$ inches; width of steam-port, 3 inches; steam-lap, $1\frac{1}{2}$ inches; main valve to close when piston is 32 inches from beginning of stroke; cut-off variable from $\frac{1}{2}$ stroke to point of cut-off of main valve, due to its lap; greatest distance between centres of cut-off valve and main valve, 4 inches (Ex. = $4''$); blocks to be in contact when following farthest ($x=0$). Find, first, travel of cut-off valve in inches; second, minimum length of blocks; third, width of main valve between outer edges of ports; fourth, point of cutting-off with blocks 3 inches apart. Scale of crank-circle, $1\frac{1}{2}''=1$ foot. All valve-circles full size.

8. Give pounds of coal consumed per hour in supply of a pair of engines of 1,700 I. H. P., requiring 26 pounds of steam per I. H. P. Pressure, per gauge, 40 lbs. Temperature of feed-water 110° Fah. Give also square feet of grate surface, of heating surface, and of calorimeter, the boilers being of the vertical water-tube kind.

9. Give square feet of condensing surface and diameter of circulating pump, using data of questions 2 and 7. Pump, double-acting; stroke, $48''$; temperature of injection, 70° Fah.; of discharge, 80° Fah.

10. Give area of feathering-paddles required by vessel in question 1; slip 25 per cent. of given speed; to work in still water.

SECOND CLASS.**DESIGNING OF MACHINERY.****ANNUAL EXAMINATION.**

JUNE, 1878.—Time allowed, five hours.

1. Prove that the angular velocities of two arms are inversely as the perpendiculars from their centres of motion upon the link.
2. Two shafts meet, making an angle of 80° ; the angular velocity-ratio of the driver and follower is $\frac{3}{4}$; required, the angles of the pitch cones for bevel gear.
3. Define pitch circle. Given, a wheel of 31.82 inches diameter and 100 teeth, required, the pitch.
4. Two wheels, with constant directional relation, driver to revolve uniformly, follower to revolve twice to the driver's once, and to remain at rest half the time. Sketch device by which this can be accomplished, and give the ratio of the radii of the two wheels.
5. Apply the second solution to the formation of the teeth of wheels.
6. Prove that involute teeth preserve a constant velocity-ratio when the distance between the axes is varied.
7. Lay down a cam that will give a bar whose line of direction passes through the axis of the cam a uniform reciprocating motion.
8. Two shafts at right angles lie in horizontal planes 15 feet apart; upon the upper or driving shaft is a pulley 30 inches in diameter, which is to be connected with a pulley on the lower shaft by an endless belt, so that the angular velocity-ratio shall be $\frac{3}{4}$. Required, the diameter of the lower pulley and the positions upon the shafts of both.
9. Determine the motion of a slide when the path of the end of the link travels in a line tangent to the circle described by the extremity of the crank-arm.
10. Construct geometrically a quick-return motion, such that the period of return shall be one-third the period of advance.
11. Give, the train for a thirty-two day clock fitted with a seconds' pendulum, and to carry but 16 coils on the winding barrel.
12. Define an epicyclic train. Find the velocity-ratios of epicyclic trains.
13. The counter-shaft of a lathe makes 86.4 revolutions per minute, the cones have 4 pulleys each, and the lathe has back-gear. The changes are to be by geometric progression from 4 revolutions per minute upward. Deduce the sizes of the pulleys and the train for the gears, the common ratio being 1.75, and the sum of the diameters 20 inches.
14. Sketch a differential pulley. State the condition of equilibrium.
15. Design a feed motion for a drill-press, such that the feed shall be uniform and $\frac{1}{60}$ of an inch per revolution.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.**STRENGTH OF MATERIALS.****SEMI-ANNUAL EXAMINATION.**

January, 1878.—Time allowed, five hours.

1. Show that the sum of the moments of inertia of a surface relatively to a pair of rectangular neutral axes is isotropic.
- A closed hemispherical vessel filled with liquid is held with a point in its edge uppermost; find its position when the sum of the pressures on the concave and plane surfaces is the greatest possible.

2. Show that if the stresses on a given pair of planes be tangential to those planes and parallel to a third plane which is perpendicular to the pair of planes, the stresses must be of equal intensity.

If a hemispherical vessel whose weight is W , floats upon a fluid with one-third of its axis below the surface, find the weight which must be put into the vessel in order that it may float with two-thirds of its axis below the surface.

3. Define *elasticity, stress, strain, toughness, stiffness, and resilience*.

Determine the ratio of the radii in the case of a thick hollow cylinder subjected to given external and internal pressures.

4. Derive the formula for moment of flexure of beams, $M = \frac{P}{y} I$.

Find the greatest deflection of a beam of uniform strength and breadth uniformly loaded and supported at both ends.

5. A beam of uniform strength and depth is fixed at both ends and uniformly loaded: find the maximum deflection, maximum moment of flexure, and points of contrary flexure.

6. Find the limiting length of a rectangular oak beam, in which $\frac{l}{h} = 20$, and whose weight per cubic foot is 51.84 lbs., the resistance to breaking across being 10,000 lbs. per square inch, and the factor of safety 5.

Show that for equal values of the limiting stress f , the resistance of a cylinder, solid or hollow, to wrenching, is double its resistance to breaking across.

7. Derive the formula for the proper thickness of the teeth of toothed wheels.

In the case of pillars and struts, find the ratio of the stress due to direct pressure to the additional stress due to bending.

8. Define the terms *jet, current, vortex, and steady motion*.

State the general principles of continuity and derive the general differential equation of continuity.

9. Show that in steady motion the sum of the height due to the velocity of a particle and of its dynamic head is constant.

The times of emptying a segment of a sphere through equal small orifices in its vertex and base are as 2 to 3, the base being horizontal in both cases; compare the volume of the segment with that of the sphere.

10. Define *free, forced, and combined vortices*, and show that in a free circular vortex, the velocity is inversely as the distance from the axis.

Find the pressure of a jet against a fixed surface.

METHOD OF LEAST SQUARES.

ANNUAL EXAMINATION.

JUNE, 1878.—Time allowed, five hours.

1. Classify and define the errors likely to occur in ordinary observations. What principles form the basis of the law of the probability of error?

2. A number of coins is tossed up; derive the general expression for finding the probability of any particular combination. A person tosses up two coins together four times; what is the probability that two heads will be thrown once at least?

3. Derive the equation of the probability curve $y = ce^{-h^2x^2}$, and determine the constant c .

4. Explain why the term *least squares* is used; define *measure of precision, probable error, and weight*, and distinguish between the terms *error* and *residual*. A line is measured five times, and the probable error of the mean is found to be 0.016 ft.; how many additional measurements of the same precision are necessary in order that the probable error of the mean shall be only 0.004 ft.?

5. Derive the formula for determining the probable error of an observation of weight unity in the case of direct observations of unequal precision upon a single quantity, and thence deduce the formula for the probable error of the general mean.

6. A certain line was measured by three different surveying parties, and the following results were obtained: *1st party*, 5110, 5090, 5140, 5100, 5120; *2nd party*, 4980, 5100, 5220, 5160, 5040, 5100; *3rd party*, 5105, 5100, 5110, 5105. Determine the relative weights of the three means and the most probable length of the line.

7. In the case of independent observations, of unequal weight, upon several quantities, derive the requisite formulas, and develop the method of finding the most probable values of the quantities and of determining the probable errors of the results.

8. A chronometer is rated at a certain date, and is found to be $9^m 12^s.3$ fast, with a probable error of $0^s.3$; ten days afterward it is again rated and is found to be $9^m 22^s.4$ fast, with the same probable error; determine the probable error of the mean daily rate. Having given the observation equations, $2x + y = 7$, with weight 5; $x + 3y = 6$, with weight 1; $x - y = 2$, with weight 4; find the values and the weights of x and y .

9. In the case of conditioned observations of unequal weight upon several quantities, develop the method of finding the most probable values of the quantities and the probable errors of these values.

10. At the point O , four angles are measured:— $AOR = x = 40^\circ 52' 37''$, with weight 16; $BOC = x = 92^\circ 25' 4''$, with weight 4; $COD = y = 80^\circ 03' 15''$, with weight 3; $DOA = z = 146^\circ 35' 20''$, with weight 1; required the most probable values of the angles x , y , and z .

INDEX

- Board, 11.
- n of Cadet-Midshipmen, Exam-
for, 49.
- n of Cadet-Midshipmen, Regula-
overning, 49.
- n of Cadet-Engineers, Examina-
; 58.
- n of Cadet-Engineers, Regula-
overning, 57.
- Course in, 63.
- Examination for admission in,
Engineers, 58.
- examination-papers, 69, 70.
- ic, Examination for admission in,
58.
- drills, 62.
- y, Course in, 63.
- y, examination-paper, 86.
- instruction in, 62.
- ineers, Admission of, 57.
- icers, 11.
- Course in, 64.
- examination-papers, 79, 88, 90.
- , Academic, 6.
- , Civil, 7.
- y, Course in, 64.
- y, examination-paper, 81.
- its, Table of, 34, 35.
- ive examination for admission of
Engineers, 58.
- tion, Officers and Cadet-Midship-
S. S., 32.
- ion, Examination-paper, 82.
- instruction, 62.
- ractice, 32.
- Instruction in, 62.
- 0.
- , Sections of fourth class, 44.
- n admission, 53.
- g of machinery, examination-
103, 104.
- Course in, 65.
- courses, 37, 63, 65.
- y, examination-paper, 87.
- Course in, 65.
- examination-papers, 74, 75.
- Examination-papers, 1877-78, 69.
- Expenses, 53.
- Fencing, Instruction in, 62.
- First class, Cadet-Midshipmen, relative
standing, 14.
- First class, Cadet-Midshipmen, merit-roll,
38.
- First class, Cadet-Engineers, relative
standing, 26.
- First class, Cadet-Engineers, merit-roll, 45.
- Fourth class, Cadet-Midshipmen, 23.
- Fourth class, Cadet-Midshipmen, merit-
roll, 43.
- Fourth class, Cadet-Engineers, 29.
- Fourth class, Cadet-Engineers, merit-roll,
47.
- French, Course in, 65.
- French, examination-papers in, 71, 83.
- Geography, Examination for admission in,
55, 56, 60.
- Geometry, Course in, 63.
- Geometry, Examination for admission in,
Cadet-Engineers, 59.
- Geometry, examination-paper, 71.
- Geometry, Analytical, examination-paper,
79.
- Geometry, Descriptive, examination-pa-
pers, 78.
- Graduating class, relative standing, Cadet-
Midshipmen, 12.
- Graduating class, relative standing, Cadet-
Engineers, 25.
- Grammar, Examination for admission in,
55, 56, 60.
- Gunnery, Course in, 62.
- Gunnery, examination-papers, 86, 95.
- Gymnastics, Instruction in, 62.
- Heat, examination-paper, 99.
- Historical sketch, 4.
- History, Course in, 65.
- History, examination-papers, 72, 73.
- Japan, Students from, 29.
- Law, Course in, 65.
- Law, examination-paper, 99.
- Marine engines, examination-papers, 96,
102.
- Marine garrison, Officers of, 10.

- Mates, 10.
 Mayflower, U. S. S., Officers and Engineers of, 33.
 Mechanics, Course in, 64.
 Mechanics, examination-papers, 89.
 Merit-rolls, Explanation of, 37.
 Method of least squares, examination-paper, 105.
 Mortar-practice, 62.
 Natural philosophy, Examination for admission in, 59.
 Naval architecture, Course in, 64.
 Naval construction, Course in, 62.
 Naval construction, examination-paper, 93.
 Naval History, Examination-paper, 81.
 Navigation, Course in, 64.
 Navigation, examination-papers, 97, 98.
 Officers of the Naval Academy, 8.
 Officers not attached to the Academic Staff, 10.
 Physics, Course in, 64.
 Physics, examination-papers in, 80.
 Programme of recitations, 66.
 Reinstatements, 30.
 Resignations, 30.
 Rhetoric, Course in, 65.
 Rhetoric, examination-paper, 81.
 Rifle-match, 31.
 Seamanship, Course in, 62.
 Seamanship, examination-papers, 83, 93.
 Second class Cadet-midshipmen, relative standing, 16.
 Second class, Cadet-Midshipmen, merit-roll, 40.
 Second class, Cadet-Engineers, relative standing, 27.
 Second class, Cadet-Engineers, merit-46.
 Ship-building, examination-paper, 94.
 Signals, Exercises in the use of, 62.
 Spanish, Course in, 65.
 Spanish, examination-paper, 92.
 Spelling, Examination for admission 55, 56.
 Staff, Academic, 8.
 Steam-engineering, Course in, 63.
 Strength of materials, examination-paper, 104.
 Summary, 29.
 Surveying, Course in, 64.
 Swimming, Instruction in, 62.
 Tactics, Course in, naval and infantry.
 Tactics, examination-paper, infantry.
 Tactics, examination-paper, naval, 84.
 Text-books, 62, 63, 64, 65.
 Theme periods, 67, 68.
 Theory of equations, examination-paper, 72.
 Third class, Cadet-Midshipmen, relative standing, 19.
 Third class, Cadet-Engineers, relative standing, 28.
 Third class, Cadet-Midshipmen, 1877-merit-roll, 42.
 Third class, Cadet-Engineers, merit-46.
 Traveling expenses, 53.
 Trigonometry, Course in, 63.
 Trigonometry, examination-papers, 76.
 Visitors, Board of, 5.

415
43
Storage
4th

ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

THIRTIETH ACADEMIC YEAR,

1879-80.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1879.

CONTENTS.

HISTORICAL SKETCH.....	Page
BOARD OF VISITORS.....	
ACADEMIC CALENDAR.....	
CALENDAR, 1879-80.....	
OFFICERS.....	
ACADEMIC BOARD.....	
CADET-OFFICERS.....	
CADETS, WITH RELATIVE STANDING IN CLASSES.....	
NUMERICAL SUMMARY.....	
RESIGNATIONS AND DISMISSALS.....	
ANNUAL RIFLE-MATCH.....	
PRACTICE-CRUISE, 1879.....	
TABLE OF COEFFICIENTS.....	
MERIT-ROLLS, 1878-79.....	
REQUISITES FOR ADMISSION.....	
COURSE OF INSTRUCTION.....	
PROGRAMME OF RECITATIONS.....	
EXAMINATION-PAPERS, 1878-79.....	
INDEX TO EXAMINATION PAPERS.....	

GIFT
EAN M. E. COOLEY
9-14-1932 ✓

THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by Hon. George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The course was fixed at five years, of which the first and last only were spent at the School, the intervening three being passed at sea. This arrangement was not strictly adhered to, the exigencies of the service making it necessary, in some cases, to shorten the period of study. In January, 1846, four months after the opening of the School, the students consisted of 36 Midshipmen, of the date of 1840, who were preparing for the examination for promotion; 13 of the date of 1841, who were to remain until drafted for service at sea; and 7 Acting Midshipmen, appointed since September of the previous year. The Midshipmen of the date of 1840 were the first to be graduated, finishing their limited course in July, 1846, and they were followed in order by the subsequent dates until the reorganization of the School, in 1851.

In September, 1849, a Board was appointed to revise the plan and regulations of the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. DuPont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation July 1, 1850.

The new organization provided for a course of seven years, the first two and last two at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, and its name was changed to the United States Naval Academy. The corps of professors was enlarged, the course was extended, and the system of separate departments, with executive heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Secretary of the Navy. A suitable vessel was attached to the Academy as a practice-ship, and annual practice-cruises were begun.

After the system had been in operation a year new changes were proposed, and the recommendations of the Academic Board on the subject were referred to the Board of Examiners of the year 1851, composed of the following officers:

Commodore David Conner,
Captain Samuel L. Breese,
Commander C. K. Strickling,
Commander A. Bigelow,
Commander Franklin Buchanan,
Lieutenant Thomas T. Craven.

The change recommended by the Board of Examiners, and adopted by the Department, consisted mainly in leaving out the requirement of three years of sea-service.

the middle of the course, thus making the four years of study consecutive. The practice-cruises supplied the place of the omitted sea-service, and gave better opportunities of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in three years, and were graduated in June, 1854; the rest of the class followed in 1855.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the frigates *Constitution* and *Santee*. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class was graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and was graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years instead of two; and the new provision was first applied to the class entering the Academy in the year 1874. This class was graduated in June, 1878.

SUPERINTENDENTS OF THE NAVAL ACADEMY SINCE ITS FOUNDATION.

Assumed Command—

- Sept. 3, 1845.—Commander Franklin Buchanan.
- March 15, 1847.—Commander George P. Upshur.
- July 1, 1850.—Commander Cornelius K. Stribling.
- Nov. 1, 1853.—Commander Louis M. Goldsborough.
- Sept. 15, 1857.—Captain George S. Blake.
- Sept. 9, 1865.—Rear-Admiral David D. Porter.
- Dec. 1, 1869.—Commodore John L. Worden.
- Sept. 22, 1874.—Rear-Admiral C. R. P. Rodgers.
- July 1, 1878.—Commodore Foxhall A. Parker.
- Aug. 2, 1879.—Rear-Admiral George B. Balch.

BOARD OF VISITORS, JUNE, 1879.

Commodore T. H. STEVENS, U. S. N., *President*.
 Hon. M. J. DURHAM, Danville, Ky., *Vice-President*.
 Chief-Engineer J. W. KING, U. S. N.
 General JAMES GRANT WILSON, New York City.
 General ELI H. MURRAY, Louisville, Ky.
 Colonel WILLIAM GODDARD, Providence, R. I.
 Captain JOHN M. BROOKE, Lexington, Va.
 Hon. H. B. ANTHONY, Providence, R. I.
 Hon. J. R. McPHERSON, Jersey City, N. J.
 Hon. W. R. MYERS, Anderson, Ind.
 Rev. EBENEZER BUSHNELL, Fremont, Ohio.

ACADEMIC CALENDAR.

1879--80.

1879.		
Oct.	1.—Beginning of first term.....	Wednesday.
1880.		
Jan.	26-31.—Semi-annual examination	Monday-Saturday
Jan.	31.—End of first term	Saturday.
June	1-10.—Annual examination.....	Monday-Wednesday
June	10.—End of academic year, 1879-80	Wednesday.
June	11.—Examination of candidates for admission as Cadet-Midshipmen	Thursday.
Sept.	15.—Examination of candidates for admission as Cadet-Engineers	Tuesday.
Sept.	22.—Examination of candidates for admission as Cadet-Midshipmen	Tuesday.
Oct.	1.—Beginning of first term, 1880-81.....	Thursday.

The academic months end on the following days:

1879-80.

October.....	Nov. 1	February.....	Feb
November.....	Nov. 29	March.....	Mar
December.....	Dec. 27	April.....	Apr
January.....	Jan. 24	May.....	May

CALENDAR FOR 1879-80.

SEPTEMBER.							MARCH.						
Sun.	M.	T.	W.	T.	F.	Sat.	Sun.	M.	T.	W.	T.	F.	Sat.
....	1	2	3	4	5	6	1	2	3	4	5	6	7
7	8	9	10	11	12	13	8	9	10	11	12	13	14
14	15	16	17	18	19	20	15	16	17	18	19	20	21
21	22	23	24	25	26	27	22	23	24	25	26	27	28
28	29	30	....	....	....	....	29	30	31	....	....	....	....
OCTOBER.							APRIL.						
....	....	....	1	2	3	4	....	....	....	1	2	3	4
5	6	7	8	9	10	11	5	6	7	8	9	10	11
12	13	14	15	16	17	18	12	13	14	15	16	17	18
19	20	21	22	23	24	25	19	20	21	22	23	24	25
26	27	28	29	30	31	....	26	27	28	29	30	....	....
NOVEMBER.							MAY.						
....	....	....	....	....	....	1	....	....	....	....	....	1	2
2	3	4	5	6	7	8	3	4	5	6	7	8	9
9	10	11	12	13	14	15	10	11	12	13	14	15	16
16	17	18	19	20	21	22	17	18	19	20	21	22	23
23	24	25	26	27	28	29	24	25	26	27	28	29	30
30	....	....	....	....	....	....	31	....	....	....	....	....	....
DECEMBER.							JUNE.						
....	1	2	3	4	5	6	....	1	2	3	4	5	6
7	8	9	10	11	12	13	7	8	9	10	11	12	13
14	15	16	17	18	19	20	14	15	16	17	18	19	20
21	22	23	24	25	26	27	21	22	23	24	25	26	27
28	29	30	31	....	....	....	28	29	30	....	....	....	....
JANUARY.							SEPTEMBER.						
....	....	....	....	1	2	3	....	....	1	2	3	4	5
4	5	6	7	8	9	10	6	7	8	9	10	11	12
11	12	13	14	15	16	17	13	14	15	16	17	18	19
18	19	20	21	22	23	24	20	21	22	23	24	25	26
25	26	27	28	29	30	31	27	28	29	30	....	....	....
FEBRUARY.							OCTOBER.						
....	....	....	....	....	....	....	....	....	....	1	2	3	....
1	2	3	4	5	6	7	4	5	6	7	8	9	10
8	9	10	11	12	13	14	11	12	13	14	15	16	17
15	16	17	18	19	20	21	18	19	20	21	22	23	24
22	23	24	25	26	27	28	25	26	27	28	29	30	31

OFFICERS OF THE UNITED STATES NAVAL ACADEMY

REAR-ADMIRAL GEORGE B. BALCH

SUPERINTENDENT.

COMMANDER S. D. GREENE,

Senior Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER F. V. McNAIR,

Commandant of Cadets.

LIEUTENANT W. H. BROWNSON,

Assistant to the Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION

COMMANDER E. M. SHEPARD,

Head of Department.

LIEUTENANT-COMMANDER FRANCIS A. COOK,

LIEUTENANT-COMMANDER EDWIN WHITE,

LIEUTENANT LEAVITT C. LOGAN,

LIEUTENANT D. DELEHANTY,

Instructors in Seamanship, Naval Tactics, and Naval Construction

MATTHEW STROHM,

Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY

COMMANDER A. T. MAHAN,

Head of Department.

LIEUTENANT JOHN C. SOLEY,

LIEUTENANT W. H. PARKER, Jr.,

LIEUTENANT J. W. MILLER,

LIEUTENANT RICHARD RUSH,

Instructors in Naval Gunnery, and Infantry Tactics

ANTOINE J. CORRESIER,

Sword-Master.

JEAN B. RIETZ,

GEORGE HEINTZ,

Assistant Sword-Masters.

OFFICERS OF THE UNITED STATES NAVAL ACADEMY.

MATHEMATICS.

PROFESSOR W. W. HENDRICKSON

Head of Department.

LIEUTENANT-COMMANDER F. W. DICKINS,
LIEUTENANT BENJAMIN F. TILLEY,
LIEUTENANT S. C. PAINE,
LIEUTENANT H. O. RITTENHOUSE,
LIEUTENANT G. L. DYER,
MASTER C. W. BARTLETT,

Instructors in Mathematics.

STEAM-ENGINEERING.

CHIEF ENGINEER J. P. SPRAGUE,

Head of Department.

PASSED ASSISTANT ENGINEER L. W. ROBINSON, C. E., M. M. E.,
PASSED ASSISTANT ENGINEER J. C. KAUFER,
PASSED ASSISTANT ENGINEER C. H. MANNING,
PASSED ASSISTANT ENGINEER R. W. MILLIGAN,
PASSED ASSISTANT ENGINEER G. H. KEARNEY,
ASSISTANT ENGINEER A. MATTICE,
ASSISTANT ENGINEER A. V. ZANE,

Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

LIEUTENANT-COMMANDER ALLAN D. BROWN,

Head of Department.

LIEUTENANT-COMMANDER C. J. TRAIN,
LIEUTENANT RAYMOND P. RODGERS,
LIEUTENANT WILLIAM J. BARNETTE,

Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

PROFESSOR HENRY D. TODD,

Head of Department.

LIEUTENANT CHARLES BELKNAP,
MASTER SIDNEY A. STAUNTON,
PROFESSOR N. M. TERRY, A. M., Ph. D.,
PROFESSOR CHARLES E. MUNROE, S. B.,

Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR J. M. RICE, S. B.,

Head of Department.

LIEUTENANT M. R. S. MACKENZIE,
LIEUTENANT SAMUEL W. VERY,
LIEUTENANT CHARLES A. STONE,

Instructors in Mechanics and Applied Mathematics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR J. RUSSELL SOLEY, A. B.,

Head of Department.

LIEUTENANT FREDERICK M. WISE,
 LIEUTENANT JOHN V. B. BLEECKER,
 LIEUTENANT ROBERT T. JASPER,
 LIEUTENANT GEORGE W. TYLER,
 MASTER CHARLES H. LYMAN,
 MASTER CHARLES R. MILES,
 ASSISTANT PROFESSOR WILLIAM W. FAY, A. M.,

Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,

Head of Department.

LIEUTENANT ARTHUR B. SPEYERS,
 ASSISTANT PROFESSOR A. V. S. COURCELLE,
 ASSISTANT PROFESSOR EUGENE DOVILLIERS,
 ASSISTANT PROFESSOR JULES LEBOUX,
 ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,

Head of Department.

MASTER CORWIN P. REES,
 ASSISTANT PROFESSOR C. F. BLAUVELT, N. A.,

Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF

COMMANDER HENRY B. ROBESON, *In charge of Practice-Ships.*
 MEDICAL DIRECTOR A. L. GIBON, A. M., M. D.
 SURGEON M. L. RUTH, M. D.
 PASSED ASSISTANT SURGEON ROBERT SWAN, M. D.
 PAYMASTER A. S. KENNY, A. B., *Commissary.*
 PAYMASTER F. H. SWAN, *Storekeeper.*
 PAYMASTER W. N. WATMOUGH, *Treasurer.*
 CHAPLAIN ROBERT HUDSON, M. A.
 ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
 J. J. GRAFF, *Assistant Librarian.*
 R. M. CHASE, *Secretary.*

MARINE GARRISON.

CAPTAIN ROBERT W. HUNTINGTON, *Commanding.*
 FIRST LIEUTENANT GEORGE B. HAYCOCK.

BOATSWAIN C. E. HAWKINS.
 GUNNER ROBERT SOMMERS.

MATES.

C. J. MURPHY	{ Attached to the United States Gunnership Ship and to the Sloop-of-war Dale.
SAMUEL GEE	
WILLIAM G. SMITH	
JAMES HILL	
ROBERT SILVER	{ Attached to the United States Steamer Nautilus (iron-clad).
BENJAMIN G. PERRY	
JOSEPH RODGERS	{ Attached to the United States Steamer Philadelp ^h tender.

ACADEMIC BOARD.

REAR ADMIRAL G. B. BALCH, U. S. N.
 COMMANDER F. V. McNAIR, U. S. N.
 COMMANDER A. T. MAHAN, U. S. N.
 COMMANDER E. M. SHEPARD, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 CHIEF ENGINEER J. P. SPRAGUE, U. S. N.
 LIEUTENANT-COMMANDER A. D. BROWN, U. S. N.
 PROFESSOR J. M. RICE, S. B., U. S. N.
 PROFESSOR J. R. SOLEY, A. B., U. S. N.
 PROFESSOR H. D. TODD, U. S. N.
 PROFESSOR L. F. PRUD'HOMME, A. M.
 PROFESSOR MARSHAL OLIVER.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER

FRANCIS J. HAESELER.

CADET-LIEUTENANTS.

H. C. POUNDSTONE.
FRANKLIN SWIFT.

JOSEPH BEALE.
P. W. HOURIGAN.

CADET-MASTERS.

M. C. GORGAS.
A. CRAMER.

E. SIMPSON, JR.
J. S. WATTERS.

P. R. ALGER, *Adjutant*.

CADET-ENSIGNS.

L. S. NORTON.
G. L. DILLMAN.

C. CABANISS.
W. J. MAXWELL.

CADET-PETTY-OFFICERS.

First Captains of Gun's Crews.

J. C. Drake.
O. H. P. Belmont.
W. S. Sims.
J. B. Bernadou.

J. F. Luby.
L. S. Van Duzer.
W. Truxtun.
A. P. Niblack.

F. R. Brainard.
W. W. Buchanan.
T. Worthington.
James Gray.

J. H. Rohrbacker.
A. R. Howze.
H. L. Fillebrown.
W. H. Wolfersberger.

Second Captains of Gun's Crews.

F. W. Bowdon.
A. A. Ackerman.
J. L. Shock.
J. A. Hoogewerff.

F. C. Rider.
R. B. Dashiell.
R. P. Forshaw.
A. S. McCrea.

F. H. Hunicks.
C. P. George.
W. H. Stayton.
G. G. Rodgers.

W. L. Emmet.
M. Craven.
G. P. Blow.
J. H. Lindsey.

CADET-PASSED-ASSISTANT-ENGINEER.

W. F. DURAND.

CADET-ASSISTANT-ENGINEERS.

A. W. STAHL.

C. E. MANNING.

Cadet-Machinists.

W. S. Sample.
A. E. Smith.

H. Hall.
L. D. Miner.

J. L. Wood.
T. W. Kinkaid.

A. O. Young.
A. T. Woods.

CADET-MIDSHIPMEN.

Class of 1879—41 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Number of quarters.	Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Naval construction.	Naval architecture (elective).	Ordnance.	Marine engines.	Navigation.	Light and heat.	Law.	Spanish.	Months.	Days.
*1	Miner, Randolph Huntington	Ohio	June 19, 1875	15	7	3	3	2	2	2	3	3	1	3	4	19
*2	Hood, John	Alabama	Sept. 15, 1875	15	9	5	4	2	3	1	1	1	2	12	4	19
*3	Clements, Abner Brush	Missouri	June 21, 1875	17	6	15	9	1	14	4	3	2	5	11	50	4
*4	Hayden, Edward Everett	Massachusetts	June 21, 1875	16	2	13	5	4	9	5	4	7	9	2	71	4
5	Chase, Henry Sanders	Louisiana	June 21, 1875	16	10	9	14	5	4	3	6	4	6	3	99	4
6	Moore, John McJonnell	Indiana	June 21, 1875	17	6	6	2	6	7	10	8	8	3	6	85	4
7	Garrett, Le Roy Mason	New York	Sept. 16, 1875	18	0	2	11	.....	5	8	5	9	10	1	54	4
8	Marsh, Charles Carleton	Indiana	Sept. 14, 1875	17	1	10	7	.....	10	14	10	10	7	5	103	4
9	Sloan, Robert Sage	New York	June 21, 1875	15	7	7	8	.....	1	14	14	16	12	23	73	4
10	Jungen, Charles William	Wisconsin	Sept. 24, 1874	15	6	7	12	.....	12	12	17	15	13	10	62	4
11	Blish, John Bell	Indiana	Sept. 15, 1875	15	0	12	30	.....	16	9	13	20	8	14	76	4
12	Harrow, Charles Henry	New York	Sept. 15, 1875	17	0	4	1	.....	6	7	12	27	14	7	43	4
13	Wilke, Harvey	Illinois	Sept. 16, 1875	14	5	21	28	7	24	21	7	5	32	33	125	4
14	Gill, William Andrew	Pennsylvania	June 21, 1875	10	5	14	10	.....	11	6	9	5	22	16	103	4
15	Schwerin, Remond Pierre	New York	Sept. 25, 1875	16	1	11	6	.....	8	16	14	12	16	19	50	4
16	Biploy, Charles Steadman	At large	June 17, 1875	17	11	32	13	.....	30	11	30	27	20	27	43	4
17	Gibson, John	Kentucky	Feb. 16, 1874	18	0	28	25	.....	17	18	16	14	14	19	30	4
18	Caboon, James Blake	Vermont	June 16, 1874	17	6	14	35	.....	16	33	16	17	13	20	94	4

19	Seas, Walter Jean	Pennsylvania	June 21, 1875	17	8	17	18	18	13	11	10	20	8	61	4	19
20	Garrett, Leigh Osborn	Illinois	Sept. 13, 1875	15	1	1	16	13	24	20	23	26	25	64	4	19
21	Mendee, Daniel Preston	California	Sept. 23, 1874	10	6	20	20	23	25	24	10	27	8	74	4	19
22	Snowden, Thomas	New York	June 21, 1875	17	10	30	23	19	30	31	29	4	15	22	4	19
23	Dougherty, John Allen	Missouri	June 12, 1874	16	9	18	27	20	26	22	35	29	29	37	4	19
24	Hell, John Arthur	West Virginia	June 12, 1874	10	11	20	32	25	17	29	24	23	32	85	4	19
25	Tilman, Edwin Ford	Tennessee	Sept. 14, 1874	16	10	37	22	35	19	28	13	29	36	85	4	19
26	Kellogg, Francis Woodruff	Connecticut	June 21, 1875	17	10	20	35	29	20	17	29	31	26	71	4	19
27	Gibbons, John Henry	Michigan	Sept. 15, 1875	16	8	34	18	36	38	37	31	16	18	104	4	19
28	Robinson, Herbert Judson	New Hampshire	Sept. 15, 1875	16	6	25	23	36	38	37	24	32	12	132	4	19
29	Cunningham, Andrew Chase	New York	June 9, 1874	16	4	21	36	26	40	41	41	41	40	70	4	19
30	Barnard, Louis Hall	Colorado	June 13, 1874	16	11	23	34	33	38	34	36	34	17	76	4	19
31	Brown, Guy Warner	Indiana	June 19, 1875	17	2	26	36	32	23	22	22	25	37	43	4	19
32	Thom, William Arthur	At large	June 21, 1875	17	8	38	32	27	34	25	34	24	22	26	4	19
33	Lopez, Robert Files	Tennessee	Sept. 23, 1874	17	6	36	38	40	32	36	31	36	30	84	4	19
34	Drayton, Percival Langdon	At large	June 10, 1874	16	2	24	17	37	26	30	30	27	21	107	4	19
35	Read, Maurice Lance	South Carolina	Sept. 23, 1874	15	10	35	31	31	26	33	33	11	23	61	4	19
36	Mudd, John Alexis	At large	Sept. 11, 1875	15	3	33	21	27	37	26	37	37	35	125	4	19
37	Graham, William Alfred	New York	Sept. 23, 1874	14	11	31	38	38	34	38	38	38	37	57	4	19
38	Biller, Reuben Oscar	Pennsylvania	June 19, 1875	16	1	39	40	41	33	40	40	35	28	77	2	19
39	Parcell, John Lewis	New Jersey	Sept. 26, 1873	17	4	19	13	21	41	23	39	14	33	69	5	8
40	Welsh, George Slavis	Pennsylvania	Sept. 24, 1874	17	7	41	29	33	26	34	26	40	40	106	4	19
41	Sturdivant, Harry Leland	Maine	June 13, 1874	17	8	40	41	38	36	39	17	39	39	123	2	19

CADET-MIDSHIPMEN.

First class—61 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—							Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Seamanship.	Naval tactics.	Ordnance instruction and infantry tactics.	Astronomy.	Electricity.	Mechanics and applied mathematics.	English composition.	French.	Months.	Days.
8	Ackerman, Albert Ammetman	New Jersey	June 21, 1876	16	11	25	30	10	6	6	6	59	41	5	4
41	Alger, Philip Bounseville	At large	Sept. 11, 1876	17	0	8	27	2	2	1	1	35	5	5	4
44	Ashmore, Henry Beckwith	At large	Oct. 3, 1876	15	4	46	32	49	46	33	42	22	34	5	4
54	Beale, Joseph	Pennsylvania	Oct. 12, 1874	14	10	9	30	28	29	26	31	48	16	5	4
49	Belmont, Oliver Hazard Perry	New York	Sept. 30, 1874	14	10	46	65	44	50	50	46	56	9	5	8
4	Bernadon, John Baptiste	At large	Sept. 12, 1876	17	10	10	44	4	21	15	2	15	1	5	4
37	Bowdon, Frank Welch	Texas	Sept. 11, 1875	17	7	44	21	29	50	55	44	3	17	5	4
34	Brainard, Fred Roland	Illinois	June 21, 1876	17	8	42	35	38	15	14	20	27	63	5	4
61	Brinley, Edward	At large	Sept. 18, 1876	16	3	66	39	62	55	62	46	60	40	5	4
59	Brown, James Stephen	Tennessee	Sept. 31, 1875	17	2	61	51	61	61	34	48	48	62	5	4
15	Buchanan, Wilson Wildman	Ohio	June 19, 1875	17	8	11	7	14	5	18	12	62	48	5	5
60	Bullitt, Howard Henry	Kentucky	Sept. 11, 1875	17	11	59	66	66	60	61	57	35	64	5	4
55	Cabaniss, Charles	Virginia	June 21, 1876	16	8	13	18	25	18	53	50	40	73	5	4
56	Clark, Lewis Jacob	Alabama	Sept. 11, 1876	14	7	62	42	47	49	48	28	65	56	5	8
51	Cramer, Ambrose	Maryland	Sept. 28, 1874	17	6	62	54	42	44	23	43	53	(a)	5	5
51	Devery, Theodore Gibbs	South Carolina	June 19, 1875	16	9	65	58	22	57	28	50	12	40	5	4
28	Dickson, Joseph Morrill	Texas	June 14, 1876	15	5	51	49	35	29	39	25	47	26	5	8
17	Dillman, George Lincoln	Iowa	June 19, 1876	16	1	20	48	47	24	40	11	24	21	5	4
36	Drake, James Colburn	Arkansas	June 19, 1875	17	11	45	22	44	40	56	14	38	43	5	4

Second class—79 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice-ships.		
				Years.	Months.	Mathematics.	Physics and chemistry.	History.	History and rhetoric.	French.		Drawing.	Months.	Days.
27	Andrews, Horace Burlingame	Michigan	June 22, 1876	15	1	26	44	36	10	28	56	2	0	
41	Ballentine, Henry Laird	Tennessee	June 20, 1877	16	6	53	42	7	25	68	202	2	0	
30	Barnett, George	Wisconsin	June 19, 1877	17	6	35	22	29	69	44	46	2	0	
48	Blow, George Preston	Virginia	Sept. 14, 1876	15	11	53	31	42	72	33	181	2	0	
77	Bonilla, Thomas Lewis	Missouri	June 19, 1875	17	8	76	68	63	75	67	127	2	16	
50	Bryan, Samuel	Maryland	June 14, 1876	17	3	57	36	40	35	49	130	2	0	
40	Buck, Guy Morville	Maine	Sept. 11, 1877	16	10	35	54	49	62	34	49	2	0	
21	Burtis, Frank Emory	Ohio	June 20, 1877	16	1	28	33	21	17	31	37	2	0	
14	Capehart, Edward Everett	Ohio	June 22, 1877	17	11	14	15	12	8	39	65	2	0	
11	Carroll, Eugene	At large	June 19, 1877	16	2	8	24	17	28	21	129	2	0	
28	Clarke, George	Illinois	June 22, 1877	14	11	27	35	56	51	58	202	2	0	
44	Cockle, Rudolphus Rouse	Illinois	June 21, 1875	17	8	42	44	30	49	37	214	2	0	
60	Cohen, Harry Radcliffe	At large	June 20, 1877	15	4	62	66	49	68	26	51	2	0	
42	Colwell, James Ham	At large	June 20, 1877	16	10	39	56	30	39	50	81	2	0	
68	Craig, Ben Holliday	Missouri	June 14, 1876	16	8	73	66	52	57	61	103	2	0	
75	Craven, Macdonough	New York	June 21, 1876	17	7	74	77	72	46	6	188	2	0	
43	Crenshaw, James Davis	Texas	Sept. 11, 1877	17	10	34	62	63	42	25	78	2	0	
8	Dashell, Robert Brooke	At large	June 19, 1877	16	11	11	11	10	5	2	22	2	0	
63	Donnelly, Michael Joseph	Wisconsin	June 21, 1877	17	7	71	55	38	38	51	158	2	0	
19	Doyen, Charles Augustus	New Hampshire	June 21, 1876	16	9	24	18	15	11	34	139	2	0	
54	Dresser, James Walter	Minnesota	June 21, 1877	16	8	44	47	72	54	41	189	2	0	
17	Eldredge, Houston	At large	Oct. 2, 1876	15	7	21	27	9	13	46	63	2	0	
64	Emmet, William Le Roy	At large	June 26, 1876	16	11	59	21	65	79	10	226	2	0	

CADET-MIDSHIPMEN.

Second class—79 members—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.	Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.							Months.	Days.
78	Enosye, Yonoke.....	Empire of Japan.....	Sept. 18, 1877	19	0	80	80	80	.....	42	8	2	16
79	Flournoy, William Francis.....	Louisiana.....	June 19, 1877	17	9	25	59	37	12	80	191	2	0
80	Ford, William Griffith.....	Arkansas.....	Sept. 11, 1877	15	7	67	52	72	77	71	186	2	0
81	Forslow, Robert Pierpont.....	New York.....	June 21, 1876	16	11	37	12	3	15	59	45	2	0
82	George, Charles Peaslee.....	Illinois.....	July 1, 1876	16	3	48	70	46	44	16	112	2	0
83	Gresham, William Albert.....	Indiana.....	June 19, 1875	17	3	50	44	52	51	18	52	2	16
84	Haines, Henry Cargill.....	At large.....	June 26, 1875	15	7	18	29	29	39	9	165	2	0
85	Hains, Robert Peter.....	Maine.....	Sept. 18, 1876	16	3	47	26	45	51	17	118	2	0
86	Harmon, Eugene Marion.....	Ohio.....	June 20, 1877	17	10	70	64	43	62	48	240	2	0
87	Harrison, Edward Hasson.....	At large.....	June 21, 1877	15	10	37	36	47	75	64	72	2	0
88	Hasson, Alexander Ritchie.....	At large.....	June 21, 1875	15	4	78	42	49	60	14	169	2	16
89	Hoogwerff, John Adrian.....	At large.....	June 21, 1877	16	7	7	4	14	22	15	71	2	0
90	Honicka, Felix Harmon.....	Missouri.....	Sept. 11, 1877	17	6	27	60	25	8	1	99	2	0
91	Karmany, Lincoln.....	Pennsylvania.....	Sept. 12, 1877	17	0	15	9	19	4	29	79	2	0
92	Kass, Spencer Mettler.....	Illinois.....	Sept. 11, 1877	17	10	29	56	41	32	31	69	2	0
93	Kimball, John Arthur.....	Massachusetts.....	Sept. 12, 1877	17	0	45	18	59	31	30	121	2	0
94	Lauchheimer, Charles Henry.....	Maryland.....	Sept. 11, 1877	17	11	17	14	33	6	56	127	2	0
95	Lindsay, John Howard.....	Pennsylvania.....	June 21, 1876	16	2	67	74	79	62	63	214	2	0
96	Linnard, Joseph Hamilton.....	Pennsylvania.....	June 21, 1877	16	9	5	1	13	30	22	163	2	0

McHenry, James, 1876-77

CADET-MIDSHIPMEN, THIRD CLASS—RELATIVE STANDING. 21

19	Kenkel, Herman Henry	Minnesota	June 21, 1878	17	5	13	42	32	1	31	2	16
34	Kent, George Edward	New York	June 21, 1877	16	10	26	44	41	10	233	2	16
12	Key, Albert Lenoir	Tennessee	June 21, 1877	16	11	7	9	15	50	266	2	16
†	King, William Nephew, Jr.	Georgia	June 21, 1875	17	5						0	0
32	Larkin, John Abner	Mississippi	June 21, 1877	17	5	27	23	35	56	169	2	16
48	Lodeman, Frank Felix Emile	Michigan	June 21, 1878	14	4	49	46	15	40	234	2	16
13	Martin, Clarence	Louisiana	June 21, 1878	16	3	16	22	10	48	78	2	16
36	McGiffen, Philo Norton	Pennsylvania	Sept. 11, 1877	16	9	30	32	41	29	234	2	16
7	McNutt, Finley Alexander	Indiana	Sept. 11, 1877	16	9	13	1	6	44	225	2	16
7	McWhorter, Jacob Gray	Georgia	Sept. 12, 1877	16	2	4	13	20	37	213	2	16
31	Miner, John Rice	Ohio	June 21, 1876	15	10	38	14	34	18	227	2	16
43	Morris, Walter Ellis	Pennsylvania	June 20, 1877	16	6	46	49	50	4	133	2	16
*1	Nixon, Lewis	Virginia	June 21, 1878	17	2	1	4	12	19	62	2	16
47	Norton, Oliver Dwight	Ohio	June 21, 1877	17	11	43	46	50	38	108	2	16
5	Paine, Walter Taylor	Ohio	Sept. 11, 1877	14	11	3	21	8	51	80	2	16
46	Patterson, Samuel Achmuty Walnwright	At large	June 21, 1876	16	6	35	44	38	55	263	2	16
6	Poyer, John Martin	At large	June 21, 1877	15	9	5	5	29	35	241	2	16
27	Prince, Thomas Clayton	Ohio	June 21, 1878	17	9	33	27	38	13	47	2	16
33	Savage, Ledra Rollin	Illinois	Sept. 23, 1878	17	2	39	27	36	26	40	2	16
21	Sample, Lorenzo	Alabama	Sept. 11, 1877	16	0	22	12	4	45	216	2	16
49	Schrader, George Morrison von	Missouri	Sept. 23, 1878	16	5	51	55	49	43	135	2	16
14	Slack, William Yarnall	Missouri	June 19, 1877	16	11	17	20	23	15	36	2	16
42	Smythe, James Wilson	New York	June 19, 1877	16	5	36	50	37	30	149	2	16
15	Stable, Frederick Henry	California	Sept. 11, 1877	15	4	21	7	18	28	236	2	16
24	Strippen, Edson Webster	Nebraska	June 21, 1878	17	9	23	25	44	7	114	2	16
25	Whittlesey, William Bailey	New York	June 21, 1878	17	11	24	37	41	11	40	2	16
10	Wood, Spencer Shepard	New York	June 21, 1878	16	10	14	6	22	10	34	2	16

*In accordance with an act of Congress approved June, 1879.

CADET-MIDSHIPMEN, FOURTH CLASS.

CADET-MIDSHIPMEN.

Fourth class—61 members.

Name.	State.	Date of admission.	Age at admission.
			Yrs. Mo.
Agee, Alfred Pelham	Alabama	June 11, 1879	16
Alexander, Robert Colder	Kentucky	Sept. 22, 1879	16
Balthis, Harry Hamilton	Illinois	June 11, 1879	17
Barnard, John Hall	New York	Sept. 23, 1878	17
Belford, Samuel Elmore	Pennsylvania	Sept. 23, 1878	17
Bowman, William Ezekiel	Michigan	Sept. 23, 1879	18
Brady, Cyrus Townsend	Kansas	Sept. 23, 1879	17
Carpenter, James Franklin	Indiana	Sept. 12, 1878	15
Cassidy, Edward Rochfort	New York	Sept. 12, 1879	17
Chapin, Frederick Lincoln	Illinois	Sept. 23, 1879	18
Colvin, Frank Reginald	New York	Sept. 23, 1879	17
Cooper, James Jackson Gignulliat	Florida	Sept. 22, 1879	18
Dalrymple, Elton Wesley	Iowa	June 21, 1878	16
Dovalé, Arthur	New York	Sept. 23, 1878	17
Frazier, Robert Thomas	Tennessee	Sept. 23, 1879	18
George, Harry	Michigan	June 11, 1878	18
Gignulliat, Thomas Heywood	Georgia	Sept. 23, 1878	18
Gray, Willie Theodore	North Carolina	May 8, 1878	18
Greene, Samuel Dana, jr.	Rhode Island	June 18, 1879	18
Hepp, Charles Frederick	Missouri	June 21, 1878	17
Jackson, John Alexander	Florida	Sept. 22, 1879	17
Jackson, John Brinckerhoff	New Jersey	Sept. 22, 1879	17
Jastremski, Leon Henry	Louisiana	Sept. 22, 1879	18
Keith, Albion Sherman	Massachusetts	Sept. 22, 1879	18
Kiefer, Edmund Emerson	Pennsylvania	June 11, 1879	18
Ledbetter, William Hamilton	Texas	Sept. 22, 1879	17
Legaré, Alexander Brown	South Carolina	Mar. 26, 1878	18
Lennon, Michael Edward	Wisconsin	Sept. 22, 1879	18
Lerch, Robert Lee	Ohio	Sept. 22, 1879	18
Lorenskiold, Arlington Lee	Texas	Sept. 22, 1879	18
McCook, John Anson	New York	Sept. 22, 1879	18
McCreary, Wirt	Pennsylvania	June 11, 1879	17
McIntire, Alonzo Evans	Massachusetts	Sept. 22, 1879	18
McKean, Josiah Slutta	Ohio	Sept. 22, 1879	18
Megrath, William Alonzo	Georgia	Sept. 22, 1879	17
Mitchell, Charles Ryan	Georgia	Sept. 22, 1879	17
Mitchell, Sidney Zollicoffer	Alabama	Sept. 23, 1878	18
Morris, John Knox	Indiana	Sept. 22, 1878	17
O'Leary, Timothy Stephen	Massachusetts	Sept. 22, 1879	18
Parker, Foxhall Alexander	Iowa	Sept. 22, 1879	17
Pefley, Harlem	Idaho Territory	Sept. 22, 1879	17
Pettit, Harry Corbin	Indiana	Sept. 22, 1879	18
Philbin, Patrick Henry	Maryland	June 21, 1878	17
Plunkett, Charles Peshall	District of Columbia	Sept. 22, 1879	18
Rankin, Harry	Kansas	June 21, 1878	18
Reynolds, Charles Roberts	Arizona Territory	June 21, 1878	18
Ricketts, William Wallace	Virginia	Sept. 23, 1878	17
Salisbury, Smith	New York	Sept. 23, 1878	18
Smith, Thomas Buchanan	Alabama	June 21, 1878	17

CADET-MIDSHIPMEN.

Fourth class--61 members--Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Yrs.	Mos.
Edward Everett	Georgia.....	Sept. 17, 1878	18	0
George Clymer	Pennsylvania.....	Sept. 22, 1879	17	2
George Washington	Wisconsin.....	Sept. 22, 1879	16	7
Charles Edward.....	New York.....	Sept. 22, 1879	17	11
Edwin George.....	Wisconsin.....	Sept. 22, 1879	17	8
Benjamin Eaton.....	Indiana.....	Sept. 22, 1879	15	5
Emmet Vivian	Illinois.....	June 11, 1879	17	8
Edwin Babbitt	Oregon.....	Sept. 23, 1878	15	8
John Louis Miller.....	New York.....	Sept. 22, 1879	16	10
William Joseph.....	Ohio.....	Sept. 22, 1879	17	11
John Thomas Alfred.....	Tennessee.....	June 11, 1879	17	2
Robert Harris.....	Virginia.....	Sept. 23, 1878	17	10

CADET-ENGINEERS.
Graduating class of 1879—23 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—								Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.	Naval construction.	Steam-engineering.	Light and heat.	Physical measurements.	Mechanics.	Naval architecture.	Law.	Spanish.		Months.	Days.
*1	Gatewood, Richard	Virginia	Sept. 15, 1875	15	11	3	1	3	13	2	1	1	2	47	2	21
*2	McFarland, Walter Martin	District of Columbia	Sept. 15, 1875	16	1	9	3	1	8	3	2	5	1	54	5	20
*3	Bowles, Francis Tiffany	Massachusetts	Sept. 15, 1875	16	11	2	2	4	8	4	3	2	7	53	5	20
4	Bryan, Benjamin Chambers	New Jersey	Sept. 15, 1875	17	1	7	3	6	1	1	5	6	5	58	5	20
5	Labbe, Charles Bethel	Pennsylvania	Sept. 15, 1875	18	3	3	5	7	1	7	4	11	6	68	5	20
6	Carr, Clarence Alfred	Pennsylvania	Sept. 15, 1875	19	1	14	8	5	13	5	6	10	4	56	5	20
7	Hunt, Andrew Murray	Indiana	Sept. 15, 1875	16	2	12	6	8	1	18	7	11	3	47	5	20
8	Acker, Edward O'Connor	Pennsylvania	Sept. 15, 1875	17	4	6	7	2	1	13	9	3	14	29	5	20
9	Annan, John Wesley	Massachusetts	Sept. 15, 1875	19	0	17	9	9	6	12	21	15	9	118	5	20
10	Ivers, Henry King	Missouri	Oct. 1, 1874	18	6	14	15	11	11	9	8	17	12	95	4	27
11	Norton, Harold Percival	New York	Oct. 1, 1874	18	10	1	11	16	13	8	29	8	20	43	5	20
12	Bennett, Frank Marion	Michigan	Oct. 1, 1874	17	5	22	17	22	13	15	11	4	20	81	5	20
13	Elseoffer, Harry Smith	Iowa	Oct. 1, 1874	19	3	20	14	19	5	23	19	20	10	44	5	20
14	Talcott, Charles Gratiot	Virginia	Sept. 15, 1875	16	0	10	10	14	6	21	15	18	16	97	5	20
15	Crygier, John Ulysses	New York	Oct. 1, 1874	16	6	5	12	13	19	19	18	6	12	55	5	20
16	Lebster, Richard Thornton	Tennessee	Sept. 15, 1875	18	3	12	20	10	8	6	10	11	15	101	5	20
17	Scribner, Edward Hershel	Massachusetts	Oct. 1, 1874	19	11	10	13	17	13	17	23	22	19	62	5	20
18	Berington, Martin	Ohio	Sept. 15, 1875	17	10	8	16	15	13	14	16	8	23	72	5	20
19	Bowers, Frederic Clay	New Jersey	Sept. 15, 1875	17	7	19	18	13	20	9	11	16	8	91	5	20
20	Salisbury, George Robert	Missouri	Oct. 1, 1874	17	7	16	23	23	12	22	13	23	11	45	5	20
21	Pickrell, Joseph McCall	Virginia	Oct. 1, 1874	17	3	21	19	17	20	9	13	10	18	116	2	9
22	Baker, John Howard	Rhode Island	Sept. 15, 1875	18	6	23	22	21	22	16	17	21	22	90	5	20
23	Carter, Thomas Frederic	Kentucky	Oct. 1, 1879	18	3	18	31	20	22	19	23	11	17	51	8	30

First class—18 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Steam-engineer.	Order of merit in—					Number of demerits.	Sea-service in practice-ships.	
				Years.	Months.		Ing.	Astronomy.	Electricity.	Mechanics and applied math.	Composition.		Months.	Days.
8	Alderdee, William Hillary.....	Pennsylvania.....	Sept. 14, 1876.....	16	9	10	14	17	6	1	12	191	5	4
*2	Burand, William Frederick.....	Connecticut.....	Sept. 14, 1876.....	17	6	2	2	2	1	4	4	101	5	4
14	Hall, Harry.....	Pennsylvania.....	Sept. 14, 1876.....	17	9	15	10	8	12	10	14	84	5	4
3	Hasson, William Frederick Converse.....	Ohio.....	Sept. 14, 1876.....	19	4	6	4	7	2	5	3	141	5	4
12	King, Charles Alfred.....	Maryland.....	Sept. 14, 1876.....	18	1	12	12	10	9	6	13	117	5	4
13	Kinkaid, Thomas Wright.....	Ohio.....	Sept. 14, 1876.....	16	6	13	13	5	15	8	8	48	5	4
9	Manning, Charles Edward.....	New York.....	Sept. 14, 1876.....	17	6	8	6	5	14	3	18	71	5	4
15	Mathews, Clarence Herbert.....	Ohio.....	Sept. 14, 1876.....	19	7	14	11	12	11	13	22	89	5	4
4	Miner, Leo Dwight.....	Ohio.....	Sept. 14, 1876.....	17	7	3	5	3	4	19	20	21	5	4
5	Sample, Winfield Scott.....	Pennsylvania.....	Sept. 14, 1876.....	18	10	5	8	9	5	17	15	77	5	4
11	Smith, Albert Edward.....	Wisconsin.....	Sept. 14, 1876.....	17	8	7	7	12	13	8	16	127	5	4
18	Smith, William Strother.....	Virginia.....	Sept. 15, 1875.....	18	0	20	19	11	16	20	11	126	5	6
*1	Stahl, Albert William.....	New York.....	Sept. 14, 1876.....	19	4	1	1	1	3	2	2	122	5	4
17	Weaver, William Dixon.....	Pennsylvania.....	Sept. 14, 1876.....	19	1	16	17	14	18	6	9	207	5	4
7	Wood, Joseph Learned.....	Virginia.....	Sept. 14, 1876.....	20	2	11	14	4	7	15	1	71	5	4
6	Woods, Arthur Tarnatt.....	Massachusetts.....	Sept. 14, 1876.....	17	7	4	3	15	8	12	5	104	5	4
16	Worthington, John Leeds.....	Maryland.....	Sept. 14, 1876.....	18	3	19	18	19	17	10	7	42	5	4
10	Young, Albert Osborn.....	New York.....	Sept. 14, 1876.....	19	2	9	9	16	10	15	6	60	5	4

CADET-ENGINEERS.
Second class—27 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.		Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	Physics and Chemistry.	History and Rhetoric.	French.	Mechanical drawing.			Months.	Days.
20	Anderson, Martin Augustus	Wisconsin	Sept. 13, 1877	19	11	16	23	19	7	2	100	3	0	0
17	Arnold, Solon	Maryland	Sept. 14, 1876	22	2	22	18	4	5	24	98	3	0	0
5	Bankson, Lloyd	Pennsylvania	Sept. 13, 1877	19	9	5	2	13	11	12	98	3	0	0
24	Beach, Robert James	New York	Sept. 13, 1877	19	10	23	24	10	24	4	171	3	0	0
1	Belden, Charles Emory	Ohio	Sept. 14, 1876	18	6	.....	.....	.....	.....	.....	57	2	18	18
19	Bash, Arthur Richmond	Massachusetts	Sept. 13, 1877	17	4	14	13	26	14	3	213	3	0	0
7	Byrne, James Edwin	Massachusetts	Sept. 14, 1876	19	5	6	3	18	17	9	143	3	0	0
6	Dorst, Frank Butland	Massachusetts	Sept. 13, 1877	18	3	14	4	8	4	14	140	3	0	0
16	Eckel, Herman	Massachusetts	Sept. 14, 1876	20	2	24	8	5	2	27	44	3	0	0
22	Gartley, William Henry	Pennsylvania	Sept. 13, 1877	18	1	18	18	17	14	11	171	3	0	0
1	Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10	.....	.....	.....	.....	.....	140	5	6	6
1	Kaemmerling, Gustave	Indiana	Sept. 13, 1877	19	3	2	5	9	9	6	100	3	0	0
14	Lang, William	New York	Sept. 14, 1876	18	8	17	17	3	7	19	87	0	0	0
25	McAllister, Andrew	New York	Sept. 13, 1877	19	3	25	26	7	18	20	127	3	0	0
10	McAlpine, Kenneth	Virginia	Sept. 13, 1877	17	0	10	20	10	3	17	132	3	0	0
23	Moritz, Albert	New York	Sept. 13, 1877	17	2	21	24	25	10	18	81	3	0	0
8	Parsona, Isaac Brown	Michigan	Sept. 13, 1877	17	8	4	9	23	25	1	177	3	0	0
13	Perkins, Lyman Burnham	Connecticut	Sept. 13, 1877	18	7	13	7	20	20	7	148	3	0	0
15	Redgrave, De Witt Clinton	Maryland	Sept. 13, 1877	19	3	12	12	21	19	10	96	3	0	0
9	Sampson, Blas Clay	Illinois	Sept. 13, 1877	19	6	3	20	15	21	21	118	3	0	0
3	Shallenberger, Oliver Blackburn	Pennsylvania	Sept. 13, 1877	17	4	6	1	13	12	8	106	3	0	0
21	Smith, William Stuart	New York	Sept. 13, 1877	19	8	19	16	10	26	5	101	3	0	0
11	Stewart, Jr., Robert	Michigan	Sept. 13, 1877	10	5	19	10	1	6	26	84	2	0	0
12	Whelan, William Townsend	New York	Sept. 13, 1877	20	1	6	15	12	14	13	131	3	0	0
18	Whelan, William Winch	Pennsylvania	Sept. 13, 1877	17	11	6	14	6	21	22	147	3	0	0
2	Whitman, Jay Mansel	Illinois	Sept. 13, 1877	19	0	1	16	3	16	3	58	3	0	0
26	Whitman, Elizabeth Fairless	Virginia	Sept. 13, 1877	18	10	11	6	3	1	16	137	3	0	0

CADET-ENGINEERS.

Third class—29 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—						Sea-service in practice-ships.	
				Years.	Months.	Mathematics.	English and history.	French.	Mechanical drawing.	Number of demerits.		Months.	Days.
22	Addicks, Walter Roberts	Penn.	Oct. 1, 1878	17	5	24	16	23	11	120		2	16
5	Chambers, William Henry	Penn.	Oct. 1, 1878	19	11	8	3	11	17	85		2	16
7	Clarke, Arthur Henry	R. I.	Oct. 1, 1878	18	1	7	5	6	28	99		2	16
24	Coley, Frederick Edward	N. Y.	Oct. 1, 1878	16	8	22	24	25	7	221		2	16
11	Conant, Frank Henry	Mass.	Oct. 1, 1878	19	5	12	9	14	21	79		2	16
*2	Creighton, William Henry Paul	Ohio	Oct. 1, 1878	19	2	1	2	4	15	72		2	16
†	Day, Willis Bunner	Ohio	Sept. 13, 1877	19	10					97		3	0
9	Ferguson, George Robert	Conn.	Oct. 1, 1878	19	3	5	17	19	3	50		2	16
*3	Fitts, James Henry	Va.	Oct. 1, 1878	17	7	6	4	2	19	76		2	16
*4	Gatewood, Robert Woodland	Va.	Oct. 1, 1878	16	9	2	12	3	21	154		2	16
23	Gladstone, Daniel Demarest	N. J.	Sept. 13, 1877	18	1	20	19	13	11	259		2	16
15	Gsantner, Otto Charles	N. J.	Oct. 1, 1878	19	0	15	18	7	4	224		2	16
8	Hawthorne, Harry Leroy	Ky.	Oct. 1, 1878	19	9	9	6	18	5	92		2	16
13	Higgins, Robert Barnard	Md.	Oct. 1, 1878	20	0	13	19	8	14	118		2	16
14	Howland, Charles Henry	R. I.	Oct. 1, 1878	17	5	17	7	14	23	116		2	16
17	Leonard, John Calvin	Ohio	Oct. 1, 1878	19	3	15	13	17	26	108		2	16
25	Leopold, Harry Girard	Ohio	Oct. 1, 1878	19	6	24	23	27	8	234		2	16
6	Miller, Peter	Kans.	Oct. 1, 1878	18	7	4	8	10	24	109		2	16
12	Pendleton, Joseph Henry	Penn.	Oct. 1, 1878	18	3	11	15	20	20	151		2	16
16	Prevear, Herbert Pranker	Mass.	Sept. 13, 1877	19	8	18	22	5	1	162		2	16
19	Quinby, Isaac Henry	N. Y.	Oct. 1, 1878	17	7	14	25	16	11	274		2	16
10	Rommell, Charles Edward	Penn.	Oct. 1, 1878	16	2	10	10	12	6	46		2	16
27	Shock, Thomas Alexander Wharton	Md.	Oct. 1, 1878	18	4	27	27	23	27	54		2	16
21	Simpson, Henry Lakin	Penn.	Oct. 1, 1878	17	3	19	21	25	8	114		2	16
26	Taylor, Edward Kenyon	Mass.	Oct. 1, 1878	18	8	26	20	20	15	104		2	16
*1	Theiss, Emil	Wis.	Oct. 1, 1878	17	11	3	1	1	10	154		2	16
18	Willis, Clarence Calhoun	Mass.	Oct. 1, 1878	19	0	21	11	9	25	84		2	16
20	Winchell, Ward Philo	Ohio	Oct. 1, 1878	19	5	23	14	20	2	61		2	16
28	Youchi, Sadanori	Japan	Sept. 21, 1878	19	11	28	28		18	11		2	16

† Turned back from the second class.

CADET-ENGINEERS.

Fourth class—25 members.

Name.	State.	Date of appointment.	Age at date of examination.		Relative standing on the list of students at examination.
			Years.	Months.	
Aldrich, William Sleeper	New Jersey	Oct. 1, 1879	16	6	1
Armistead, Samuel Wilson	Virginia	Oct. 1, 1879	18	8	2
Barnes, Charles Edwin	New Jersey	Oct. 1, 1879	17	4	3
Baxter, William Joseph	Ohio	Oct. 1, 1879	20	11	4
Carswell, William Beggs	Delaware	Oct. 1, 1879	18	10	5
Darrah, William Francis	Rhode Island	Oct. 1, 1879	17	1	6
Duvall, Marius, jr.	Maryland	Oct. 1, 1879	20	3	7
Dyson, Charles Wilson	Pennsylvania	Oct. 1, 1879	17	9	8
Eaton, Charles Phillips	Wisconsin	Oct. 1, 1879	16	4	9
Ellenger, Julius	Maryland	Oct. 1, 1879	16	11	10
Ellicott, John Morris	Maryland	Oct. 1, 1879	20	4	11
Field, Harry Ashby	Virginia	Oct. 1, 1879	17	2	12
Gillis, Harry Alexander	Pennsylvania	Oct. 1, 1879	17	8	13
Glasscock, Eustace Straughn	Maryland	Oct. 1, 1879	16	5	14
Gross, Charles Jacob	Maryland	Oct. 1, 1879	17	11	15
Halstead, Alexander Seaman	Pennsylvania	Oct. 1, 1879	17	9	16
Herbert, William Cromwell	Pennsylvania	Oct. 1, 1879	15	6	17
Lawrance, William Hunter	Pennsylvania	Oct. 1, 1879	20	11	18
Littlehales, George Washington	Pennsylvania	Oct. 1, 1879	16	11	19
Palmer, James Edward	North Carolina	Oct. 1, 1879	18	7	20
Pattison, Thomas Putnam	Maryland	Oct. 1, 1879	19	6	21
Ryan, Philip Joseph	New York	Oct. 1, 1879	19	11	22
Webster, Charles Franklin	Pennsylvania	Oct. 1, 1879	17	6	23
Woodruff, Charles Edward	Pennsylvania	Oct. 1, 1879	18	11	24
Zinnell, George Frederick	Pennsylvania	Oct. 1, 1879	17	11	25

SUMMARY.

October 1, 1879.

CADET-MIDSHIPMEN.

First class	61 members
Second class	79 members
Third class	32 members
Fourth class	61 members

CADET-ENGINEERS.

First class	18 members
Second class	27 members
Third class	29 members
Fourth class	25 members

Total

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States approved July 27, 1868.

RESIGNATIONS AND DISMISSALS.

November 1, 1878, to November 1, 1879.

RESIGNATIONS.

Cadet-Engineer H. G. Dungan.....	Feb. 7, 1879
Cadet-Midshipman J. F. Will.....	Mar. 19, 1879
Cadet-Midshipman W. F. Babcock.....	Mar. 20, 1879
Cadet-Midshipman R. W. Forrest.....	Mar. 20, 1879
Cadet-Midshipman T. B. Franklin.....	Mar. 21, 1879
Cadet-Midshipman P. Kennett.....	April 24, 1879
Cadet-Midshipman J. Taylor.....	May 14, 1879
Cadet-Midshipman A. S. Cooke.....	May 14, 1879
Cadet-Engineer H. P. Prevear.....	Oct. 24, 1879

DROPPED.

Cadet-Midshipman R. R. Gurley.....	July 24, 1879
Cadet-Midshipman J. B. Bailey.....	Aug. 20, 1879
Cadet-Midshipman P. B. Cooke.....	Aug. 20, 1879
Cadet-Midshipman L. Levissee.....	Aug. 20, 1879
Cadet-Midshipman E. B. Webster.....	Aug. 20, 1879
Cadet-Midshipman E. W. Foster.....	Aug. 20, 1879
Cadet-Midshipman J. P. Porter.....	Aug. 20, 1879
Cadet-Midshipman C. T. Phythian.....	Aug. 20, 1879
Cadet-Midshipman J. L. Wickes.....	Aug. 20, 1879
Cadet-Engineer F. M. Lillebridge.....	Aug. 20, 1879
Cadet-Engineer C. A. Miller.....	Aug. 20, 1879
Cadet-Engineer H. R. McCreary.....	Aug. 20, 1879
Cadet-Engineer A. Nichols.....	Aug. 20, 1879

ANNUAL RIFLE-MATCH

BETWEEN MEMBERS OF THE CLASS OF 1879.



Target showing score of H. L. Sturdivant.

TERMS OF THE MATCH.

Target, that adopted by the National Rifle Association of 1875.	Position, that of a skirmisher lying down
Distance, 400 yards.	Number of shots, 7.
Rifle, Remington Navy.	Possible score, 35.

Name.	1.	2.	3.	4.	5.	6.	7.	Total.
H. L. Sturdivant	5	5	5	5	5	4	4	33
L. M. Garrett	5	3	5	5	5	5	3	31
E. E. Hayden	5	5	4	5	4	4	4	31
J. L. Purcell	5	5	3	5	4	4	3	29
H. S. Chase	5	3	5	5	3	3	4	28
Total								152

Average score of class 17.2

SUMMER CRUISE, 1879.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION

Commander F. V. McNAIR, *Commanding*.
Lientenant M. R. S. MACKENZIE, *Executive Officer*.
Lientenant S. W. VERY, *Navigator*.
Lientenant D. DELEHANTY, *Watch-Officer*.
Lientenant W. J. BARNETTE, *Instructor in Navigation*.
Lientenant R. T. JASPER, *Watch-Officer*.
Lientenant S. C. PAINE, *Watch-Officer*.
Master S. A. STAUNTON, *Watch-Officer*.
Master C. W. BARTLETT, *Watch-Officer*.
Paymaster, A. S. KENNY.
Chaplain, R. HUDSON.
Surgeon, M. L. RUTH.
Passed Assistant Surgeon R. O. WHITING.
Paymaster's Clerk, JAMES MCGREGOR.
Clerk to Commandant of Cadets, C. M. McLEOD.

CADET-MIDSHIPMEN.

First class (62).

Ackerman, A. A.	Dickson, J. M.	Howze, A. R.	Rohrbacker, J. H.
Alger, P. R.	Dillman, G. L.	Huntoon, F. A.	Safford, W. E.
Ashmore, H. B.	Drake, J. C.	Lieper, E. F.	Scott, R. H.
Beale, Joseph	Dresel, H. G.	Luby, J. F.	Sims, W. S.
Belmont, O. H. P.	Duncan, L.	Maxwell, W. J.	Simpson, E.
Bernadou, J. B.	Emerson, W. H.	Mayer, A. N.	Swift, F.
Bowdon, F. W.	Eyre, M. K.	Morgan, S.	Truxtun, W.
Brainard, F. R.	Fillebrowne, H. L.	Muir, W. C. P.	Van Duzer, L. S.
Brinley, Edward	Finley, H. M.	Nash, E. W.	Wall, F. R.
Brown, J. S.	French, G. R.	Niblack, A. P.	Watters, J. S.
Buchanan, W. W.	Gorgas, M. C.	Norton, L. S.	West, G. E.
Bullitt, H. H.	Gray, J.	Parke, T. A.	Wilkinson, E.
Cabaniss, C.	Haeseler, F. J.	Phelps, H.	Wolfersberger, W. H.
Clark, L. J.	Haskell, P. D.	Poundstone, H. C.	Worthington, T.
Cramer, A.	Hill, C. H.	Richardson, W. G.	
Dewey, T. G.	Hourigan, P. W.	Rodman, H.	

Second class (6).

Bonfils, T. L.	Gresham, W. A.	McKee, L. T.	Perry, G. E.
Enouye, Y.	Hasson, A. R.		

Third class (52).

Anderson, E. A.	Eames, H. H.	Kenkel, H. H.	Paine, W. T.
Arnold, J. T.	Field, R. M.	Kent, G. E.	Patterson, S. A. W.
Ashby, S.	Fletcher, W. B.	Key, A. L.	Poyer, J. M.
Barnard, J. H.	Fowler, H.	Launkin, J. A.	Prince, T. C.
Bell, E. N.	Grambs, W. J.	Lodeman, F. F. E.	Savage, L. R.
Bennett, L. S.	Gwyn, L. S.	Martin, C.	Semple, L.
Blake, R. B.	Hayden, T. W.	McGiffin, P. N.	Slack, W. Y.
Blandin, J. J.	Howard, W. L.	McNutt, F. A.	Smythe, J. W.
Conway, J. J.	Horst, H. A.	McWhorter, J. G.	Stable, P. H.
Dent, S. H.	Hubbard, N. M.	Miner, J. R.	Sutphen, E. W.
Doyle, J. G.	Hoke, W. P.	Morris, W. E.	Von Schrader, G.
Dudley, C. J.	Jayne, J. L.	Nixon, L.	Whittelsey, W. E.
Duncan, W. B.	Johnston, M.	Norton, O. D.	Wood, S. S.

The Constellation sailed from Annapolis June 18, and arrived in Hampton B. June 20; from thence on her practice-cruise, touching at Halifax, Mount Desert, Harbor, Portland, Me., Isle of Shoals, Rye Beach, Boston, New Bedford, Buzz Bay, Bristol, and Newport, R. I., and sailed from thence August 25 for Annapolis, anchored off the Naval Academy August 29, 1879.

UNITED STATES PRACTICE-STEAMER MAYFLOWER.

Lieutenant-Commander W. M. Folger, *Commanding*.

Lieutenant L. C. Logan, *Executive Officer*.

Passed Assistant Engineer C. H. Manning.

Assistant Engineer A. V. Zane.

Cadet-Engineers B. C. Bryan and C. A. Carr, *Assistant Instructors*.

Assistant Surgeon E. H. Marsteller.

CADET-ENGINEERS, FIRST CLASS.

Alderdice, W. H.	King, C. A.	Sample, W. S.	Woods, A. T.
Durand, W. F.	Kinkaid, T. W.	Smith, A. E.	Worthington, J. I.
Hall, H.	Manning, C. E.	Stahl, A. W.	Young, A. O.
Hasson, W. F. C.	Mathews, C. H.	Weaver, W. D.	Smith, W. S.
Hogan, T. J.	Miner, L. D.	Wood, J. L.	

UNITED STATES PRACTICE-STEAMER STANDISH.

Lieutenant-Commander F. W. Dickens, *Commanding*.

Lieutenant J. W. Miller, *Executive Officer*.

Passed Assistant Engineer R. W. Milligan.

Cadet-Engineers W. M. McFarland and J. F. Baker, *Assistant Instructors*.

Assistant Paymaster M. C. McDonald.

Assistant Surgeon James E. Gardner.

CADET-ENGINEERS, THIRD CLASS.

Addicks, W. R.	Fitts, J. R.	Leonard, J. C.	Shock, T. A. W.
Chambers, W. H.	Gatewood, R. W.	Leopold, H. G.	Simpson, H. L.
Clarke, A. H.	Gladstone, D. D.	Miller, P.	Taylor, E. K.
Coley, F. E.	Gsantner, O. C.	Pendleton, J. H.	Theiss, E.
Conant, F. H.	Hawthorne, H. L.	Prevear, H. P.	Willis, C. C.
Creighton, W. H. P.	Higgins, R. B.	Quinby, J. H.	Winchell, W. F.
Ferguson, G. R.	Howland, C. H.	Rommell, C. E.	Youchi, S.

The practice-steamers Mayflower and Standish steamed from the Naval Academy June 13; touched at Norfolk, Va.; New Castle and Wilmington, Del.; Chester, Philadelphia, Pa.; Perth Amboy, N. J.; Cold Spring and New York City, N. Y.; London, Conn.; New Bedford, Mass.; Bristol and Newport, R. I.; returning to at Navy-Yard, Washington, and anchored at the Naval Academy August 30, 1879.

Table of coefficients to be applied to the final averages in each branch in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Subject.	Coefficients.				Graduating maxima for required studies.
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.	
Seamanship.....	Seamanship.....	2	3	10	16	148
	Ship-building.....				4	
	Naval Tactics.....			2		
Ordnance and Gunnery....	Ordnance Instructions and Infantry Tactics.....			5		76
	Ordnance and Armor.....				14	
Mathematics.....	Algebra and Geometry.....	8				104
	Trigonometry.....		8			
	Analytical Geometry.....		7			
	Descriptive Geometry.....		3			
Steam-Engineering.....	Marine Engines.....				13	52
Astronomy, Navigation, and Surveying.....	General Astronomy.....			6		92
	Theoretical Navigation.....				9	
	Practical Navigation.....				8	
	Surveying, Compass Deviations.....					
Physics and Chemistry....	Physics and Chemistry.....		4	5		80
	Light and Heat.....			5		
	Electricity.....				6	
Mechanics and Applied Mathematics.....	Mechanics and Applied Mathematics.....			14		56
	Naval Architecture.....				*12	
English Studies, History, and Law.....	English and History.....	5				76
	History and Rhetoric.....		6			
	Composition.....			5		
	Public Law.....				3	
Modern Languages.....	French.....	2	5	5	3	60
Drawing.....	Drawing.....	2	2			16
Maximum for each year, exclusive of electives.....		76	152	228	304	760
Deduction for each demerit.....		.004	.007	.013	.03	

* Elective.

Table of coefficients to be applied to the final averages in each branch in preparing the rolls.

CADET-ENGINEERS.

Department.	Subject.	Coefficients.			
		First year—fourth class.	Second year—third class.	Third year—second class.	Fourth year—first class.
Seamanship	Ship-building .....	.....	.....	.....	.....
Mathematics	Algebra and Geometry	9	.....	.....	.....
	Trigonometry .....	.....	8	.....	.....
	Analytical Geometry .....	.....	7	.....	.....
	Descriptive Geometry .....	.....	6	.....	.....
Steam-Engineering	Mechanical Drawing	3	5	.....	.....
	Fabrication of Machinery .....	.....	.....	6	.....
	Designing of Machinery .....	.....	.....	5	.....
	Marine Engines .....	.....	.....	.....	12
Astronomy, Navigation, and Surveying	General Astronomy .....	.....	.....	4	.....
	Physics and Chemistry .....	.....	4	3	.....
Physics and Chemistry	Light and Heat .....	.....	.....	3	.....
	Electricity .....	.....	.....	.....	8
	Physical Measurements .....	.....	.....	.....	7
Mechanics and Applied Mathematics	Mechanics and Applied Mathematics .....	.....	.....	16	.....
	Mechanics .....	.....	.....	.....	11
	Naval Architecture and the Method of Least Squares .....	.....	.....	.....	6
	Elective course in Naval Architecture .....	.....	.....	.....	12
English Studies, History, and Law	English and History	5	.....	.....	.....
	History and Rhetoric .....	.....	6	.....	.....
	Composition .....	.....	.....	3	.....
	Public Law .....	.....	.....	.....	7
Modern Languages	French	2	5	3	2
Maximum for each year, exclusive of electives		76	152	228	304
Deduction for each demerit		.004	.007	.012	.02

MERIT-ROLLS FOR 1878-79.

Merit-rolls, made out yearly for each class, show the proficiency of the Cadets in each branch of study. The numbers given in the preceding table, showing the relative weight of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the Cadet for the year.

In the case of Cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 2.50.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

"Cadets who attain 85 per cent. of the multiple in any year shall be distinguished by a star affixed to their names on the merit-rolls."—(Regulations U. S. Naval Academy, § 150.)

Cadets whose names are marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

a denotes absence from examination.

MIDSHIPMEN.

Class of 1877 (42 members). Final examination, June, 1879.

Order of merit.	Name.	Seamanship.		Naval tactics.		Gunnery.		French.		Steam-engineer- ing.		Navigation.		Aptitude.		Aggregate.		Aggregate for four years.		Final aggregate.	
		48		12		48		24		48		48		12		240		751.91		991.91	
*1	William F. Fullam	44.40		11.79		39.36		18.60		39.84		44.40		12.00		210.39		660.18		870.57	
2	Horace M. Witzel	39.24		9.75		33.36		18.00		35.52		40.80		9.90		186.57		655.53		842.10	
3	Winczo G. Dodge	42.36		9.93		30.72		19.08		38.40		44.40		9.90		194.79		620.33		820.33	
4	William G. David	36.72		9.90		39.36		19.08		34.44		43.80		9.00		192.00		623.66		816.56	
5	John M. Orchard	38.64		9.09		33.84		19.80		36.36		42.00		9.00		188.73		610.01		798.74	
6	Hiero Taylor	37.96		8.75		37.20		18.42		32.40		43.20		10.50		188.01		602.95		790.30	
7	Russel C. Paris	38.62		11.55		35.88		21.00		31.44		34.80		9.00		182.19		603.93		785.35	
8	Alfred Jeffries	38.88		8.25		426.28		17.58		428.68		38.40		11.10		169.17		613.93		784.83	
9	William V. Bronaugh	36.96		9.93		428.68		17.82		33.84		39.00		9.00		173.23		590.17		781.40	
10	John N. Jordan	38.28		8.97		31.82		17.28		33.60		43.80		8.40		182.25		598.95		780.40	
11	Augustus F. Fechteler	38.40		8.58		37.08		18.90		36.72		38.40		10.50		188.88		590.95		773.53	
12	Thomas M. Brumby	37.56		9.54		35.08		16.86		37.20		40.20		8.40		184.84		570.70		764.90	
13	Edward E. Wright	43.20		8.40		32.88		17.28		41.64		39.00		9.00		191.40		560.48		757.88	
14	Jonathan K. Brice	37.56		9.69		33.96		17.58		34.56		37.80		8.10		179.25		578.21		757.46	
15	Albert Gleaves	42.96		8.76		33.84		17.10		37.56		37.20		11.40		188.82		550.92		748.44	
16	Solin E. Woodworth	36.36		17.20		33.36		19.62		39.48		31.80		9.90		185.94		562.90		748.44	
17	Frank M. Bostwick	35.88		11.01		35.64		18.00		35.88		40.20		7.50		179.10		565.95		748.05	
18	James P. Parker	34.08		10.59		36.24		16.02		39.84		35.40		9.00		181.17		551.22		738.81	
19	Harry C. Wakenshaw	33.70		9.39		31.92		13.50		36.72		34.80		12.00		174.09		550.24		733.35	
20	Walter M. Constant	32.76		8.10		31.56		13.50		36.72		34.80		12.00		174.09		550.24		733.35	
21	Ben. W. Hodges	32.76		7.95		27.00		19.20		34.80		41.40		9.60		177.24		549.11		726.35	
22	James H. Oliver	34.56		10.14		36.12		15.60		34.32		40.20		8.10		171.33		554.06		725.39	
23	Herbert O. Dunn	37.56		7.71		39.24		17.28		38.88		38.40		10.50		187.20		534.72		721.92	
24	Arthur W. Dodd	39.06		9.09		32.58		16.62		36.96		37.20		8.40		167.55		532.09		720.54	
25	George W. Denfold	36.12		8.40		32.64		15.66		38.40		33.00		9.90		182.37		536.69		719.06	
26	Albert W. Grant	36.00		9.30		31.32		17.88		39.12		38.00		10.50		174.60		543.71		718.31	
27	Frank W. Toppin	38.28		8.40		30.00		18.60		35.40		33.00		9.00		184.50		530.32		714.82	
28	Frank R. Heath	39.72		8.40		32.40		19.08		35.40		35.40		12.00		183.12		525.62		706.74	
29	Nicholas J. L. Halplite	37.08		17.41		426.40		15.00		35.40		33.00		9.00		172.17		523.62		706.74	
30	Harry M. Dombaugb	37.08		10.00		30.48		15.00		38.64		38.00		8.40		177.75		523.62		706.74	
31	Frank R. Chase	34.32		9.99		426.52		11.82		36.24		37.20		8.40		160.89		520.41		702.41	
32	Philip V. Lonsdale	31.20		8.97		33.96		17.40		35.88		41.40		9.60		177.24		549.11		697.03	

34	William L. Burdick	25.76	9.30	128.92	15.69	33.00	34.80	10.50	172.08	516.90	658.08
35	William R. Rush	35.40	9.90	32.88	15.69	33.00	33.60	11.40	106.26	512.46	678.72
36	William S. Benson	37.56	17.14	31.20	110.68	34.68	33.60	7.50	102.57	515.74	678.31
37	Alfred L. Hall	36.00	16.57	30.36	18.06	37.08	427.00	9.00	165.00	500.04	672.90
38	Percival J. Werlich	33.96	16.54	428.56	18.06	32.04	37.80	9.90	153.60	490.32	653.01
39	Henry A. Johnson	32.28	7.89	425.68	15.42	428.92	33.60			550.08	
40	Simon Cook										
	Valentine S. Nelson										
	Albert G. Winterhalter										

† Re-examined in September.

CADET-MIDSHIPMEN.

Merit-roll of first class (41 members), annual examination, June, 1879, and general merit-roll for four years.

Order of general merit.	Name.	Seamanship.	Naval construction.	Naval architecture (e lective).	Ordnance.	Marine engines.	Navigation.	Light and heat.	Law.	Spanish.	Conduct.	Aggregate for four years.				General aggregate for four years.
												Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	
	Maxima	60.00	16.00	3.60	56.00	52.00	64.00	32.00	12.00	12.00	.....	304.00	228.00	152.00	76.00	760.00
*1	Randolph H. Miner	50.85	13.83	2.64	49.70	46.80	55.52	27.44	11.19	10.50	0.87	267.45	204.71	138.03	63.43	673.62
*2	John Hood	49.65	13.60	2.64	40.28	47.71	56.32	29.36	11.16	9.21	2.55	266.38	199.41	137.30	64.04	667.13
*3	Abner E. Clements	45.60	12.76	3.12	45.08	45.24	56.00	27.52	10.56	9.36	1.50	253.74	199.94	139.40	65.49	655.49
*4	Edward E. Hayden	46.65	12.16	2.40	46.48	45.11	55.36	25.52	10.41	10.74	2.13	253.70	201.00	137.48	61.21	654.09
5	Henry T. Chase	48.60	12.08	2.28	48.58	45.76	53.12	26.24	10.50	10.50	2.97	254.69	188.44	127.92	57.11	628.16
6	John M. Moore	49.35	13.02	2.16	47.46	42.12	51.52	25.44	11.10	10.05	2.55	250.57	185.70	122.80	57.32	616.48
7	LeRoy M. Garrett	51.60	12.52	2.16	48.30	42.64	53.44	24.40	10.38	11.04	1.62	252.70	185.44	120.16	56.16	614.46
8	Charles C. Marsh	48.30	12.92	.....	46.34	40.82	50.24	24.16	10.47	10.38	3.09	240.54	183.01	118.80	58.47	601.42
9	Robert T. Sloan	48.90	12.88	.....	51.10	40.82	49.12	22.64	10.32	8.55	2.19	242.14	175.33	117.54	57.37	592.38
10	Charles W. Jungon	48.90	12.44	.....	45.64	41.00	48.00	22.80	10.20	9.18	1.86	237.20	177.26	115.68	59.09	589.23
11	John B. Ellish	46.95	11.16	.....	44.52	42.38	40.44	22.00	10.44	9.18	2.28	233.70	185.33	111.84	55.40	586.43
12	Charles H. Harlow	50.70	14.48	.....	48.16	43.16	49.92	21.12	10.08	9.99	1.29	246.32	172.66	110.36	55.06	584.40
13	Harvey Wike	43.65	11.28	2.04	41.16	39.26	52.00	25.68	9.21	8.04	3.75	228.37	177.73	118.85	56.85	582.00
14	William A. Gill	46.20	12.64	.....	45.92	44.65	50.40	25.68	9.48	8.04	3.09	241.17	167.16	112.65	52.65	573.63
15	Rennie P. Schwert	48.00	13.00	.....	47.18	40.69	49.12	23.36	9.84	8.91	1.50	238.60	170.47	105.90	56.81	571.78
16	Charles S. Ripley	42.00	12.60	.....	40.18	41.86	43.04	21.12	9.54	8.28	1.29	216.73	168.44	112.59	58.92	556.68
17	John Gilman	42.45	11.40	.....	44.38	40.30	48.80	23.04	9.72	8.19	0.90	227.38	161.31	110.04	57.09	553.82
18	James B. Calhoun	45.45	11.40	.....	44.80	39.13	46.72	22.32	9.78	8.85	1.62	227.43	166.02	111.40	49.54	554.89
19	Walter J. Sears	42.00	11.76	.....	43.82	41.34	50.08	24.16	9.54	9.54	1.83	233.71	162.09	105.53	50.47	552.40
20	Leigh O. Garrett	52.05	11.96	.....	45.50	38.61	46.24	21.44	9.36	8.40	1.92	233.71	167.50	103.91	49.08	552.13
21	Daniel P. Menefee	44.10	11.72	.....	42.56	38.48	44.48	22.08	9.33	9.84	2.22	226.37	167.73	103.59	50.42	548.11
22	Thomas Snowden	42.30	11.44	.....	43.68	37.83	40.08	21.04	10.71	9.12	0.66	221.54	162.92	105.99	52.23	541.97
23	John A. Dougherty	44.70	11.36	.....	43.40	38.00	45.76	20.36	9.40	8.23	1.11	224.04	155.13	105.75	55.90	536.82
24	John A. Hall	42.75	10.84	.....	41.02	40.56	43.52	19.32	9.35	8.10	2.63	215.05	152.57	105.08	54.36	531.06
25	Edwin H. Tillman	40.35	11.52	.....	40.48	39.01	43.84	23.20	9.30	7.92	2.55	213.97	159.03	101.37	54.00	528.36
26	Frederic W. Kallag	42.75	10.68	.....	40.32	38.30	43.00	22.00	9.24	8.37	2.13	213.97	159.03	101.37	54.00	528.36
27	John H. Robinson	41.76	11.44	.....	43.70	37.50	44.00	21.00	9.15	8.51	1.19	212.65	157.92	100.18	52.90	524.60
28	Harvey J. Robinson	43.90	11.44	.....	43.06	37.50	44.00	21.00	9.15	8.51	1.19	212.65	157.92	100.18	52.90	524.60

33	Robert F. Lepp	35.00	10.84	40.46	36.14	44.32	20.40	0.42	8.73	0.78	208.53	180.83	96.64	52.43	518.32
34	Perceval L. Drayton	40.50	10.60	38.08	37.05	42.24	20.50	8.94	8.19	2.52	203.64	157.13	96.60	52.01	515.77
35	Maurice L. Rad	43.35	11.02	38.78	38.09	43.04	20.64	9.33	8.76	3.21	210.70	158.02	100.67	52.51	514.84
36	John A. Mudd	40.65	11.08	40.04	38.09	42.72	20.48	10.35	8.55	1.83	210.12	153.94	92.35	52.80	514.69
37	William A. Graham	41.55	11.00	40.46	35.49	44.16	20.00	8.88	7.95	3.75	206.34	155.08	97.80	52.09	512.13
38	Reuben O. Brier	42.15	10.60	38.50	36.14	41.12	10.28	8.82	7.89	1.71	202.70	145.55	95.51	53.23	508.57
39	John L. Purcell	37.50	10.48	36.12	36.06	30.20	18.24	9.00	8.25	2.31	193.14	147.89	83.42	49.82	487.08
40	George S. Welch	44.55	12.38	42.70	34.71	45.44	19.04	10.08	8.04	2.07	214.77	147.40	97.27	55.01	514.51
41	Harry L. Sturdivant	36.30	11.20	30.76	38.09	42.40	21.20	8.07	7.74	3.18	202.18	150.58	93.77	51.10	497.03
42		37.35	10.28	38.50	35.75	39.84	22.32	8.70	7.80	3.69	190.85	137.61	100.23	53.98	488.07

34	Frederick E. Brainard	33.00	6.14	14.29	11.82	18.00	40.80	16.10	17.95	3.17	164.03
35	Charles H. Hill	33.84	6.20	13.05	15.78	17.94	39.20	16.45	18.44	1.30	163.10
36	James C. Drake	33.80	6.08	14.05	15.84	16.03	43.12	16.05	19.18	0.87	163.04
37	Frank W. Bowden	33.72	6.04	14.90	15.18	16.14	36.68	15.50	22.15	0.40	163.02
38	Joseph M. Dickson	32.88	5.84	14.35	16.38	16.63	39.34	17.25	21.50	1.30	161.34
39	Francis R. Wall	32.88	6.78	13.93	16.02	17.10	37.38	17.45	21.82	2.37	161.03
40	Henry M. Finley	33.84	6.74	15.45	15.43	16.02	35.00	14.55	21.91	0.74	159.73
41	Edwards F. Lieper	35.88	5.92	15.00	16.26	16.50	37.00	15.30	18.70	1.49	158.87
42	William S. Sims	35.52	6.02	14.30	16.14	16.34	38.92	15.70	19.40	1.49	158.84
43	Richard H. Scott	33.36	6.10	13.85	15.43	16.03	37.10	17.00	20.74	2.39	158.54
44	Henry B. Ashmore	35.04	5.32	14.70	15.72	15.62	35.00	16.55	19.84	1.77	158.37
45	William J. Maxwell	34.92	5.74	14.45	15.54	17.10	35.14	15.55	21.10	1.20	157.65
46	Thomas Worthington	34.56	6.08	13.75	15.36	16.08	38.22	15.05	21.82	1.23	157.53
47	Walter G. Richardson	32.76	5.58	14.25	15.36	16.08	36.36	15.15	23.81	2.92	156.31
48	Horatio L. Filcbrown	33.48	5.02	13.95	15.18	17.04	36.54	16.50	18.00	1.27	155.80
49	Oliver H. P. Belmont	33.48	5.98	13.75	15.18	17.04	35.98	17.75	19.00	1.52	154.46
50	Franklin Swift	30.96	5.38	15.40	15.00	17.22	36.52	15.30	18.78	0.75	154.46
51	Theodore G. Dewey	31.44	5.72	14.15	15.54	17.40	35.70	14.50	18.52	1.77	154.37
52	Ambrose Cramer	36.48	5.60	15.10	14.46	16.08	35.98	13.10	18.41	1.70	154.29
53	John F. Luby	34.08	5.72	13.80	15.00	17.04	37.80	16.40	19.71	1.94	153.73
54	Fitz-Aubert Huntoon	32.16	6.16	12.55	15.12	15.78	37.80	16.40	18.50	2.04	153.38
55	George R. French	31.44	5.98	13.90	15.84	16.44	38.92	14.40	18.25	1.90	153.15
56	Lewis J. Clark	34.20	5.54	13.80	15.18	16.38	35.98	15.40	18.50	2.86	152.51
57	James Gray	33.24	6.58	13.50	15.18	16.60	35.42	15.70	18.80	1.69	149.87
58	Edwin W. Nash	31.80	5.89	13.25	12.78	16.26	35.76	17.40	21.15	1.17	150.63
59	Leonidas Levissee	37.20	6.00	13.15	15.06	15.00	36.26	14.95	19.03	1.20	148.49
60	Edward Brinley	29.64	6.00	13.15	15.06	15.00	36.26	14.95	19.03	1.20	148.49
61	Hugh Rodman	31.92	5.96	13.55	13.74	16.44	34.44	15.05	18.13	1.77	147.46
62	Howard H. Bullitt	31.92	4.96	12.50	13.40	15.72	35.14	16.20	17.79	1.22	147.41
63	Paul B. Cooke	32.76	5.46	14.20	13.02	15.00	31.64	14.45	19.18	2.66	143.05
64	John B. Bailey	32.16	5.84	12.65	12.36	14.58	29.68	16.60	18.95	1.70	140.73
65	Edwin B. Webster	31.32	5.38	13.60	11.58	15.30	28.42	15.20	17.72	3.03	135.49

CADET-MIDSHIPMEN.

Merit-roll of third class (81 members), annual examination, June, 1879.

Order of annual merit.	Name.	Mathematics.	Chemistry.	History, composition, and rhetoric.	French.	Drawing.	Conduct.	Aggregate.
	Maxima.....	72	32	24	16	8	.....	132
*1	J. L. Schook	74.88	29.04	20.76	11.90	7.72	0.77	143.48
*2	J. L. Rees	70.92	27.36	21.60	12.40	7.80	1.22	138.80
*3	F. C. Rider	71.28	28.88	19.32	11.52	7.82	0.45	136.27
*4	J. H. Linnard	68.04	29.04	19.80	12.20	7.16	1.07	133.37
*5	J. J. Woodward	68.58	27.20	20.46	10.84	7.44	0.48	134.10
*6	J. A. Hoogewerff	66.60	27.76	19.38	12.08	7.32	0.50	132.46
*7	F. E. Sutton	62.64	26.96	20.64	14.64	5.44	0.40	129.32
8	R. B. Dashiell	60.30	25.36	20.16	13.96	7.84	0.15	127.67
9	T. Serata	66.96	24.40	18.00	11.84	5.62	0.30	126.52
10	H. K. White	62.10	25.20	18.72	12.40	7.40	0.30	125.22
11	E. Carroll	63.72	23.84	19.14	11.96	7.18	0.90	124.68
12	C. M. Perkins	57.96	26.80	20.76	12.08	7.24	1.18	122.66
13	L. Karmany	58.14	25.76	19.02	14.08	6.64	0.55	122.68
14	E. E. Capehart	58.86	24.88	19.86	13.60	6.10	0.45	122.65
15	W. H. Stayton	60.12	25.76	19.14	11.64	5.50	1.62	120.54
16	C. H. Lauchheimer	57.06	25.12	18.00	13.92	5.52	0.89	118.73
17	H. Eldredge	55.98	23.44	20.34	13.08	5.84	0.44	118.24
18	S. Uriu	59.04	20.48	18.66	12.04	7.20	0.20	117.23
19	C. A. Doyen	54.54	24.48	10.32	13.32	6.32	0.97	117.43
20	B. G. Pierce	55.98	24.56	20.16	11.16	5.98	0.88	116.86
21	F. E. Bunta	55.80	23.04	18.72	12.48	6.54	0.26	116.32
22	H. C. Haines	56.70	23.36	18.18	11.56	7.62	1.15	116.27
23	F. J. Moses	56.34	23.44	18.36	11.80	6.70	1.14	115.96
24	R. P. Forshaw	51.12	25.20	20.94	12.56	5.46	0.31	114.67
25	J. E. Mahoney	50.58	24.08	21.42	13.08	6.32	0.79	114.66
26	F. H. Hunnicke	53.46	21.28	18.36	13.60	7.92	0.60	113.95
27	H. B. Andrews	54.18	22.16	17.88	13.40	6.66	0.39	113.69
28	F. W. Smies	52.20	23.76	18.30	11.76	7.68	0.59	113.11
29	H. B. Wilson	56.16	22.32	18.48	11.36	5.28	1.29	112.21
30	G. Barnett	51.30	24.08	18.90	10.88	5.88	0.32	110.73
31	S. M. Kase	53.10	21.60	17.58	12.08	6.54	0.48	110.42
32	W. A. Gresham	52.56	22.16	16.98	11.24	7.24	0.36	109.82
33	W. F. Flournoy	54.36	21.36	17.76	13.16	4.44	1.34	109.74
34	O. E. Weller	52.20	23.28	17.70	12.20	5.18	1.25	109.74
35	C. W. Stewart	48.60	24.88	17.22	12.56	6.86	0.86	109.26
36	A. S. McCrea	48.78	22.08	18.36	13.72	7.44	1.30	109.06
37	J. A. Kimball	49.68	24.48	16.80	11.88	6.56	0.85	108.53
38	G. Clarke	53.46	22.80	16.92	11.24	5.48	1.41	108.49
39	R. P. Hains	49.32	23.68	17.34	11.24	7.26	0.83	108.03
40	G. M. Buck	51.30	21.84	17.16	11.00	6.32	0.34	107.28
41	H. L. Ballentine	48.60	22.24	20.58	12.04	5.20	1.41	107.23
42	J. H. Colwell	50.94	21.60	18.12	11.56	5.46	0.57	107.13
43	J. D. Crenshaw	51.48	21.12	16.62	11.52	6.72	0.55	106.91
44	R. R. Cockle	50.40	22.16	18.12	11.32	6.22	1.30	106.73
45	D. L. Printup	49.68	23.04	17.46	11.12	6.10	1.24	106.16
46	E. H. Harrison	51.12	22.56	17.22	10.40	5.30	0.50	106.19
47	G. G. Rodgers	52.20	21.60	16.86	11.64	4.58	1.11	105.77
48	G. P. Blow	48.60	23.12	17.52	10.72	6.34	1.27	105.65
49	C. P. George	48.96	20.80	17.28	11.48	7.28	0.78	105.02
50	S. Bryan	48.24	22.56	17.64	11.72	5.72	0.91	104.87
51	Z. B. Vance	50.58	23.12	16.02	11.08	5.96	1.60	104.26
52	J. W. Weeks	48.96	20.32	18.00	11.36	5.86	0.34	104.18
53	S. H. Wright	48.78	20.72	16.98	11.56	6.84	0.91	103.87
54	J. W. Dresser	49.86	22.08	15.96	11.20	6.04	1.32	103.82
55	W. M. Robinson	48.42	23.56	16.68	10.84	5.64	0.97	103.17
56	W. W. Russell	46.26	21.92	16.92	14.52	5.30	1.77	103.13
57	L. McJunkin	46.44	21.20	18.06	12.00	5.56	0.24	103.02
58	G. Wilkes	47.16	22.48	16.98	11.28	6.20	1.15	102.85
59	A. C. Parsons	48.78	22.00	16.20	10.96	5.78	0.85	102.47
60	H. R. Cohen	46.80	20.96	17.16	10.92	6.70	0.36	102.19
61	S. H. Williamson	47.16	22.48	16.74	11.92	5.00	1.34	101.96
62	M. A. Orlopp	50.40	21.12	15.54	10.96	4.80	1.40	101.20
63	M. J. Donnelly	45.18	21.68	17.70	11.60	5.96	1.11	100.71
64	D. Morgan	46.80	22.00	15.66	11.12	5.18	0.94	100.60
65	T. H. Mathews	46.62	22.00	16.32	11.40	5.00	1.58	100.50
66	G. E. Perry	47.34	21.04	16.26	10.96	4.84	1.03	100.41
67	E. M. Harmon	45.72	21.04	17.46	11.00	5.74	1.68	100.29

CADET-MIDSHIPMEN—Continued.

Merit-roll of third class (81 members), annual examination, June, 1879.

Order of annual merit.	Name.	Mathematics.	Chemistry.	History, composition, and rhetoric.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	72	32	24	16	8	.....	152
68	B. H. Craig	44.64	20.96	16.98	11.12	5.44	1.14	98.00
69	A. R. Hasson	41.22	22.24	17.16	11.08	7.36	1.18	97.88
70	W. G. Ford	46.08	21.92	15.96	10.00	5.10	1.30	97.76
71	A. C. Oliphant	45.00	20.08	16.08	10.56	5.68	0.43	96.97
72	L. T. McKee	45.90	20.88	15.60	10.72	4.74	1.14	96.70
73	J. H. Lindsey	46.08	20.40	15.30	11.00	5.32	1.50	96.60
†	W. L. Emmett	47.16	24.24	16.38	9.52	7.54	1.65	103.19
†	M. Craven	44.28	20.24	15.96	11.36	7.68	1.22	98.20
†	F. Parker	40.68	20.00	16.68	14.40	7.68	1.60	97.84
5	T. L. Bonfils	43.56	20.88	16.62	10.40	5.24	0.89	95.81
5	J. P. Porter	42.30	20.32	16.08	11.16	5.56	0.83	94.59
5	E. W. Foster	43.92	20.64	15.48	9.76	5.08	1.72	93.16
5	S. Enouye	34.20	12.24	10.62	.....	5.98	0.06	62.98
	R. R. Gurley	a	a	a	a	a	0.21	.....

CADET-MIDSHIPMEN.

Merit-roll of fourth class (73 members), annual examination, June, 1879.

Order of annual merit.	Name.	Mathematics.	Drawing.	History and English.	French.	Conduct.	Aggregate.
Maxima		36	8	24	8		76
*1	Lewis Nixon	36.30	6.62	20.10	6.14	0.25	69.97
*2	John T. Arnold	34.20	7.20	18.84	5.78	0.77	65.25
*3	Lewis S. Bennett	31.77	6.50	21.12	6.56	0.71	65.25
4	William B. Fletcher	30.60	7.30	20.40	5.66	0.41	63.25
5	William T. Putne	33.66	5.36	17.94	6.64	0.32	62.28
6	John M. Poyer	31.86	5.94	19.74	5.74	0.96	62.26
7	Finley A. McNutt	29.70	5.54	21.18	6.74	0.90	62.26
8	Jacob G. McWhorter	32.85	5.92	18.42	5.92	0.85	62.25
9	William M. Howard	30.15	6.74	18.78	6.76	0.29	62.34
10	Spencer S. Wood	29.16	6.92	19.62	5.84	0.14	61.49
11	Wiley R. M. Field	30.78	5.94	17.58	6.74	0.40	60.64
12	Albert L. Key	31.05	5.38	18.78	6.02	1.06	60.37
13	Clarence Martin	30.51	5.46	17.82	6.40	0.31	59.94
14	William Y. Slack	28.53	6.74	18.00	5.82	0.14	58.89
15	Frederick H. Stahl	27.99	6.40	19.02	5.96	0.94	58.43
16	Harold H. Eames	28.17	7.14	17.76	5.94	0.66	58.35
17	William J. Grauba	29.79	6.60	17.52	5.40	0.97	58.34
18	Marbury Johnston	28.98	5.48	18.24	6.08	0.49	58.29
19	Herman H. Keukel	29.07	7.36	16.32	5.62	0.20	58.17
20	James G. Doyle	28.26	7.26	17.64	5.62	0.63	58.13
21	Lorenzo Semple	27.45	5.48	18.60	6.76	0.86	57.43
22	Henry A. Horst	26.10	6.54	18.06	6.80	0.39	57.20
23	Joseph L. Jayne	28.53	6.60	17.16	5.14	0.48	56.85
24	Edson W. Sutphen	27.27	7.06	17.70	5.28	0.46	56.85
25	William B. Whittelsey	27.18	6.88	16.80	5.34	0.16	56.44
26	Edwin A. Anderson	24.84	7.09	18.06	6.24	0.39	55.73
27	Thomas C. Prince	25.47	6.82	17.64	5.42	0.27	55.98
28	John J. Conway	25.65	5.28	18.78	5.82	0.58	54.95
29	Charles J. Dudley	27.18	6.10	16.32	5.82	0.63	54.79
30	John J. Blandin	25.56	6.00	18.12	5.80	0.72	54.78
31	John R. Miner	25.11	6.64	18.30	5.60	0.91	54.74
32	John A. Lamkin	26.64	5.16	17.76	5.56	0.68	54.44
33	Ledru R. Savage	24.93	6.50	17.64	5.50	0.16	54.43
34	George E. Kent	27.09	6.62	16.20	5.34	0.93	54.25
35	Nathaniel M. Hubbard	26.37	7.94	16.68	5.22	1.00	54.21
36	Philo N. McGiffin	25.83	6.38	17.22	5.34	0.94	53.83
37	Lawrence S. Gwyn	24.75	6.00	16.92	5.98	0.21	53.44
38	Robert B. Blake	24.57	5.40	16.56	7.54	0.96	53.11
39	Everett N. Bell	23.31	6.52	18.06	5.28	0.42	52.75
40	Thomas W. Hayden	25.20	5.28	16.08	6.14	0.90	52.80
41	Hammond Fowler	23.67	5.78	16.92	5.90	0.51	51.78
42	James W. Smythe	25.29	6.18	15.42	5.46	0.60	51.73
43	Walter E. Morris	23.58	7.22	15.96	5.14	0.53	51.35
44	Sidney H. Dent	23.40	6.86	16.38	5.06	0.36	51.34
45	William P. Hoke	24.93	4.94	17.70	5.66	1.10	51.25
46	Samuel A. W. Patterson	25.38	5.26	16.20	5.42	1.05	51.21
47	Oliver D. Norton	24.30	5.80	16.08	5.14	0.43	50.99
48	Frank F. E. Lodeman	23.22	5.74	16.08	6.02	0.94	50.13
49	George M. von Schrader	22.77	5.56	15.12	5.20	0.54	48.11
50	Stephen Ashby	23.13	5.00	15.06	5.14	0.60	47.73
†	William B. Duncan	25.47	5.70	14.70	7.16	0.98	52.65
†	Patrick H. Philbin	22.77	5.60	14.34	5.28	0.18	47.63
†	Edwin B. Weeks	22.14	5.36	14.34	5.76	0.94	46.66
†	Charles F. Hepp	20.52	6.66	15.30	5.08	0.17	47.29
†	Charles T. Phythian	20.52	6.06	15.12	5.14	0.52	46.32
†	Thomas H. Gignilliat	19.89	6.76	15.18	4.20	0.56	45.47
†	John H. Barnard	20.16	6.54	13.80	5.00	0.39	45.29
†	Charles R. Reynolds	19.17	5.14	12.06	4.82	0.25	46.94
†	Alexander B. Legaré	17.73	5.48	12.72	5.26	0.33	46.26
†	Robert H. Woods	19.26	.....	16.86	.....	0.16	45.96
†	Willie T. Gray	17.64	.....	15.30	.....	0.46	42.46
†	Elton W. Dalrymple	18.09	.....	14.10	.....	0.67	41.22
†	Sidney Z. Mitchell	16.47	.....	15.18	.....	0.34	41.31
†	William W. Ricketts	18.00	.....	13.56	.....	0.28	41.28
†	James F. Carpenter	15.93	.....	14.04	.....	0.41	39.56
†	Harry Rankin	15.39	.....	13.74	.....	1.61	36.13
†	Thomas B. Smith	14.49	.....	14.34	.....	1.24	37.59
†	John K. Morris	10.71	.....	16.56	.....	0.21	27.66
†	Arthur Dovalé	14.13	.....	12.72	.....	0.38	26.47
†	Edward E. Solomon	12.96	.....	13.50	.....	0.70	25.76
†	Joseph L. Wickes	9.45	.....	16.20	.....	1.18	18.47
†	Samuel E. Belford	9.99	.....	8.94	.....	1.05	17.88
†	Smith Salisbury	10.26	.....	7.80	.....	0.84	17.22

Order of general no.	Name.	Naval con- struction.		Steam-engin- ing.	Light and h- eavy.		Physical me- chanics.	Mechanics.	Naval arch- itecture.	Law.		Spanish.	Conduct.	Aggregate fourth year.	Aggregate third year.	Aggregate second year.	Aggregate first year.	General avg. for four y.
		16	144		32	28				30	24								12	12
	Maxima																	760
1	Richard Gatewood	12.76	131.76	27.84	21.00	32.85	26.72	11.04	10.65	1.41	273.21	202.52	135.30	68.85	679.88			
2	Walter M. McFarland	12.04	123.12	28.88	24.50	32.76	26.35	10.41	10.89	1.02	267.33	204.91	138.80	66.80	677.84			
3	Francis T. Bowles	13.88	126.72	26.40	24.50	31.23	25.85	10.80	9.27	1.59	267.07	197.77	135.74	62.76	663.34			
4	Benjamin C. Bryan	12.56	123.12	25.60	28.00	33.03	24.67	9.87	9.48	1.74	264.39	189.55	121.92	58.96	635.02			
5	Charles B. Lubbe	12.76	119.88	25.30	28.00	36.19	25.92	9.60	9.30	1.08	254.08	182.69	120.05	58.70	635.50			
6	Clarence A. Carr	11.64	117.36	26.32	21.00	31.05	24.25	9.72	10.23	1.08	240.89	186.09	122.14	56.73	614.85			
7	Andrew M. Hunt	11.92	119.16	23.84	28.00	23.94	23.66	9.69	10.62	1.41	248.82	177.77	113.84	59.71	600.14			
8	Edward O. Acker	12.60	118.08	28.72	28.00	25.11	21.59	10.71	8.49	0.87	252.45	172.43	113.79	56.65	595.36			
9	John W. Annan	11.44	114.84	23.44	23.00	25.47	16.62	9.63	8.79	0.94	233.29	168.80	104.15	50.08	571.32			
10	Henry K. Ivers	11.64	106.56	21.52	23.80	25.83	21.77	9.30	8.52	2.85	226.25	166.38	106.69	54.94	561.13			
11	Harold P. Norton	13.92	111.24	26.40	21.00	24.39	18.48	10.33	7.89	2.43	217.10	162.03	108.43	51.10	548.68			
12	Frank M. Bennett	11.00	105.84	20.64	27.30	23.22	16.80	8.94	8.19	2.91	227.60	164.09	101.14	53.21	546.04			
13	Harry S. Elseffer	11.26	109.08	21.28	26.00	23.76	17.34	9.06	8.52	1.05	222.69	161.80	107.42	54.81	543.81			
14	Charles G. Talcott	12.72	110.88	22.44	19.60	23.85	16.86	9.87	8.25	3.03	220.25	165.16	105.90	51.39	542.77			
15	John U. Crygier	11.92	106.44	22.72	24.50	26.78	19.01	9.69	8.07	1.86	217.17	158.99	103.30	57.02	536.48			
16	Richard T. Ishester	12.44	108.36	20.80	21.00	24.21	16.14	8.49	8.97	2.16	217.91	158.18	101.94	52.88	530.49			
17	Edward H. Scribner	12.44	106.24	21.36	21.00	24.93	17.04	9.84	7.50	2.73	213.17	157.04	101.61	51.83	524.25			
18	Martin Bevington	11.28	98.25	21.36	18.20	25.83	18.48	9.48	8.58	1.35	207.76	156.67	98.49	56.99	520.41			
19	Frederic C. Bowers	11.48	96.25	20.08	21.70	23.31	17.40	8.28	8.58	2.73	213.17	156.67	98.49	56.99	520.41			
20	George R. Salisbury	11.12	90.88	20.80	18.20	25.83	17.40	9.03	8.10	3.48	208.88	151.59	97.80	54.36	512.63			
21	Joseph M. Pickrell	11.12	101.88	20.48	17.50	24.39	16.92	8.91	7.77	2.88	204.32	155.44	97.85	52.10	507.31			
22	John H. Baker	11.32	99.36	20.56	17.50	23.85	16.38	9.09	8.13	1.53	205.26	154.36	97.33	49.91	506.86			
23	Thomas F. Carter																	

Order of General in

CADET-ENGINEERS.

Merit-roll of second class (18 members), annual examination, June, 1879.

Order of annual merit.	Name.	Steam-engineering.	Astronomy.	Electricity.	Mechanics and applied mathematics.	Composition.	French.	Conduct.	Aggregate.
Maxima		76	24	24	56	20	28	.....	228
*1	Albert W. Stahl	68.40	21.48	23.38	51.24	19.30	24.89	1.50	394.5
*2	William F. Durand	67.26	21.36	21.54	55.16	17.75	23.34	1.31	393.3
3	William F. C. Hasson	62.13	19.74	18.18	51.66	17.70	24.32	1.83	384.9
4	Leo D. Miner	63.84	18.36	20.64	50.90	15.65	18.49	0.37	387.6
5	Winfield S. Sample	62.51	17.40	17.70	47.74	16.00	20.12	1.00	386.6
6	Arthur T. Woods	63.46	20.04	16.50	41.86	16.50	22.58	1.25	379.3
7	Joseph L. Wood	57.57	16.02	20.04	43.40	16.05	26.16	0.82	378.3
8	William H. Alderdice	57.95	16.02	15.54	45.30	19.55	20.80	2.48	372.4
9	Charles E. Manning	59.85	17.58	19.08	37.94	18.35	19.52	0.92	371.4
10	Albert O. Young	58.14	17.34	15.90	39.48	16.05	22.34	0.78	368.6
11	Albert E. Smith	60.23	17.46	16.74	38.36	16.95	19.96	1.65	368.6
12	Charles A. King	56.81	16.68	17.52	40.04	17.55	20.54	1.62	367.6
13	Thomas W. Kinkaid	56.62	16.44	19.08	37.38	16.95	21.45	0.62	367.3
14	Harry Hall	54.91	17.22	17.94	38.78	16.90	20.53	0.44	365.6
15	Clarence H. Mathews	55.10	16.74	16.74	38.92	16.20	18.37	1.16	360.9
16	John L. Worthington	53.39	15.00	15.06	36.12	16.65	22.25	0.55	357.3
17	William D. Weaver	53.77	15.24	16.50	35.98	17.55	21.14	1.09	357.3
18	William S. Smith	52.44	14.28	17.04	36.08	15.35	20.87	1.64	355.6
	Charles E. Belden	53.58	15.96	14.46	34.16	13.80	19.71	0.74	350.3
	Thomas J. Hogan	53.77	13.80	15.24	33.74	15.20	18.82	1.82	348.3
	Clarence A. Miller	50.35	14.16	12.72	30.80	15.75	18.41	2.01	346.3
	Frederick M. Lillebridge	49.59	13.32	10.86	22.12	16.20	21.94	1.88	321.3

CADET-ENGINEERS.

Merit-roll of third class (23 members), annual examination, June, 1879.

Order of annual merit.	Name.	Mathematics.	Physics and chemistry.	History and rhetoric.	French.	Drawing.	Conduct.	Aggregate.
Maxima		72	32	24	16	8	.....	152
1	Gustave Kaemmerling	61.02	24.24	18.24	11.92	6.94	0.70	221.0
2	Jay M. Whitham	61.38	23.12	18.60	10.56	5.92	0.37	213.2
3	Oliver B. Shallenberger	52.74	27.60	17.76	11.32	6.72	0.74	215.4
4	Llewellyn F. Whittle	51.84	24.00	20.28	13.48	6.22	1.31	214.5
5	Lloyd Bankson	53.28	25.12	17.76	11.40	6.42	0.69	213.2
6	Frank B. Dowst	50.94	24.56	18.30	12.88	6.34	0.98	212.0
7	James E. Byrne	52.74	25.04	17.10	11.08	6.56	1.00	211.2
8	Isaac B. Parsons	55.08	23.20	16.56	10.32	7.50	1.24	211.4
9	Bias C. Sampson	55.80	21.36	17.40	10.64	5.94	0.83	210.1
10	Kenneth McAlpine	52.02	21.36	18.00	13.68	6.16	0.92	209.7
11	William T. Webster	52.38	22.08	17.94	11.24	6.24	0.92	208.8
12	Robert Stewart, jr	48.06	23.12	20.40	12.20	5.52	0.59	208.7
13	Lyman B. Perkins	51.12	23.92	16.80	10.76	6.92	1.44	208.4
14	William Lang	48.78	21.92	20.04	12.08	6.04	0.61	208.2
15	De Witt C. Redgrave	51.66	22.64	16.68	10.80	6.52	0.67	207.6
16	Herman Eckel	46.26	23.52	18.84	13.20	5.46	0.31	206.7
17	Solon Arnold	47.52	21.60	19.92	12.36	5.72	0.69	206.4
18	William W. White	52.20	22.16	16.68	10.56	5.84	1.03	206.4
19	Arthur R. Bush	50.94	22.32	15.84	11.24	7.14	1.49	205.3
20	Martin A. Anderson	49.32	20.88	16.86	12.08	7.48	1.12	205.3
21	William S. Smith	48.06	22.00	18.00	10.12	6.96	0.71	204.4
22	William H. Gartley	48.00	21.60	17.16	11.24	6.46	1.29	204.4
23	Albert Moritz	47.88	20.56	15.96	11.48	6.08	0.57	201.3
24	Robert J. Beach	46.44	20.56	17.28	10.52	7.08	1.20	201.6
	Andrew McAllister	44.40	20.16	18.42	10.92	6.00	0.89	200.6
	Willis B. Day	43.56	20.72	16.26	10.04	5.72	0.98	200.6
	Arthur Nichols	39.42	16.24	15.78	11.28	6.42	0.84	198.3
	Harry R. McCreary	37.80	19.20	15.72	10.00	5.04	1.29	196.7

CADET-ENGINEERS.

Merit-roll of fourth class (28 members), annual examination, June, 1879.

	Name.	Mathematics.	English and history.	French.	Drawing.	Conduct.	Aggregate.
	Maxima	36	24	8	8	.....	76
*1	Emil Theiss	33.75	22.26	8.04	6.60	0.62	70.03
*2	William H. P. Creighton	34.92	21.66	6.36	6.54	0.29	69.13
*3	James H. Fitts	32.40	20.64	7.78	6.28	0.30	66.80
*4	Robert W. Gatewood	34.38	18.84	7.52	5.92	0.62	66.04
5	William H. Chambers	31.41	21.18	5.84	6.48	0.34	64.57
6	Peter Miller	32.67	19.56	5.88	5.76	0.44	63.43
7	Arthur H. Clarke	31.68	20.34	6.16	5.64	0.40	63.42
8	Harry L. Hawthorne	30.96	19.74	5.54	6.84	0.37	62.71
9	George R. Ferguson	32.58	17.46	5.48	7.30	0.20	62.62
10	Charles E. Rommell	30.87	18.96	5.78	6.82	0.18	62.25
11	Frank H. Conant	29.61	19.26	5.70	5.92	0.32	60.17
12	Joseph H. Pendleton	30.60	17.88	5.30	6.04	0.60	59.22
13	Robert B. Higgins	28.44	17.04	6.02	6.56	0.47	57.59
14	Charles H. Howland	26.82	19.62	5.70	5.90	0.46	57.58
15	Otto C. Gsantner	26.91	17.16	6.14	7.20	0.90	56.51
16	Herbert P. Prevear	26.73	16.44	0.28	7.56	0.65	56.36
17	John C. Leonard	26.91	18.18	5.64	5.70	0.43	56.00
18	Clarence C. Willis	24.84	18.90	5.96	5.72	0.34	55.08
19	Isaac H. Quinby	27.90	15.96	5.08	6.58	1.10	55.02
20	Ward P. Winchell	24.48	18.00	5.30	7.36	0.24	54.90
21	Henry L. Simpson	26.10	16.80	5.16	6.70	0.46	54.30
22	Walter R. Addicks	24.21	17.82	5.24	6.58	0.48	53.37
23	Daniel D. Gladstone	25.02	17.04	5.74	6.58	1.04	53.34
24	Frederick E. Coley	24.75	16.02	5.16	6.80	0.88	51.85
25	Edward K. Taylor	23.76	15.78	5.30	6.54	0.42	50.96
†	Harry G. Leopold	24.21	16.26	4.80	6.70	0.94	51.03
†	Thomas A. W. Shock	23.40	14.76	5.24	5.68	0.22	48.86
	Sadanori Youchi	18.00	11.22	.....	6.30	0.04	35.48



REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; ten appointed at large. According to the act of Congress approved June 17, "There shall not be at any time more in said Academy appointed at large than As it will take some time before the number now at the Academy can be reduced, there will be no appointment at large for at least two years to come.

The nomination of candidates for admission from the District of Columbia and at large is made by the President. The nomination of a candidate from any Congressional district or Territory is made on the recommendation of the Member or Delegate and actual residents of his district or Territory.

I. Each year, as soon after the 5th of March as possible, Members and Delegates shall be notified in writing of vacancies that may exist in their districts. If such Member or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress. They will be filled by appointments from the districts in which the vacancies exist.

II. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 11th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the examination, will be examined on the 22d of September following; and should a candidate fail to report, or be found physically or mentally disqualified for admission, in June, the Member or Delegate from whose district he was nominated will be required to recommend another candidate, who shall be examined on the 22d of September following. When any of the dates assigned for examinations fall on Sunday, the examination will take place on the following Monday.

A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting nominations attempting to enter a service for which they are not fitted.

EXAMINATION.

I. Each candidate for appointment as Cadet-Midshipman must present to the Academic Board satisfactory testimonials of good moral character, and must certify on oath to his precise age, which must be over fourteen and less than eighteen years at the time of the examination. No candidate will be examined whose age does not fall within the prescribed limits.

II. Candidates must be physically sound, well formed, and of robust constitution;

they will be required to pass a satisfactory examination before a medical board composed of the surgeon of the Naval Academy and two other medical officers to be designated by the Secretary of the Navy.

VIII. Any one of the following conditions will be sufficient to cause the rejection of a candidate :

- Feeble constitution, inherited or acquired;
- Greatly-retarded development;
- Permanently-impaired general health;
- Decided cachexia, diathesis, or predisposition;
- All chronic diseases or results of injuries that would permanently impair efficiency.

viz :

- Weak or disordered intellect;
- Cutaneous and communicable diseases;
- Unnatural curvature of spine, torticollis, or other deformity;
- Permanent inefficiency of either of the extremities or articulations from any cause;
- Epilepsy or other convulsions within five years;
- Impaired vision, or chronic disease of the organs of vision;
- Great hardness of hearing or chronic disease of the ears;
- Chronic nasal catarrh, *ozæna*, polypi, or great enlargement of the tonsils;
- Impediment of speech to such an extent as to impair efficiency in the performance of duty;
- Chronic diseases of heart or lungs, or decided indications of liability to cardiac or pulmonary affections;
- Hernia or retention of testes in inguinal cavity;
- Sarcocoele, hydrocele, stricture, fistula, or hæmorrhoids;
- Large varicose veins of lower limbs, scrotum, or cord;
- Chronic ulcers.

Attention will also be paid to the stature of the candidate; and no one manifestly under size for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.

The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates who fall below the standard will receive a second and final examination in the subjects in which they fail. Deficiency in any one of the subjects at the second examination will be sufficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have the privilege of another examination for admission to the same class unless recommended by the Board of Examiners."—(*Rev. Stat.*, § 1515.)

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is required to express in figures any whole number, decimal, or mixed number; to write in words any given number; and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pounds; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such pro-

cesses, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c. ; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as of small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetics.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school arithmetics. It is essential that the candidate shall be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes, and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance (attention is specially called to the rivers and bodies of water on which cities are situated); the course of a vessel in making a voyage between well-known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as treated in the common-school text-books, embracing the following subjects: The divisions of letters and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for *comparing adjectives*; irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives; secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as the difference between *my* and *mine*, between *thou* and *you*, and the various uses of *it*; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs*; the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflection of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense-endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs*; conjunctive adverbs; the use of *prepositions*, *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under syntax.

Parsing, according to the following model; giving in the case of each word the explanation of its grammatical relation to the other words in the sentence.

Noun: Class, gender, number, person, case.

Article: Definite or indefinite; qualified noun.

Adjective: Class, compared or not compared; comparison, if admitting it; degree of comparison; qualified noun.

Personal pronoun: Person, gender, number, case.

Relative pronoun: Person, gender, number, case, antecedent.

Interrogative pronoun: Gender, number, case.

Adjective pronoun (or pronominal adjective): Class; qualified word.

Verb: Class, form, principal parts, tense, mood, voice, person, number, subject.

Adverb: Class, derivation and comparison, if derived and compared; qualified word.

Preposition: Words between which the relation is shown by the preposition.

Interjection: The kind of emotion expressed.

Conjunction: Class; words or sentences connected.

READING.—Candidates will be examined in reading aloud English prose.

WRITING AND SPELLING.—Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use.

An examination in English branches containing eight or more mistakes in spelling will not be considered satisfactory, and will be sufficient of itself to cause the rejection of the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations will receive appointments as Cadet-Midshipmen, and become inmates of the Academy. Each cadet will be required to sign articles by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy), unless sooner discharged. The pay of a Cadet-Midshipman is \$500 a year, commencing at the date of his admission.

XIV. Cadets, immediately after their admission, will supply themselves with the following articles, viz:

One parade-suit.....	\$37 7½	One straw mattress.....	\$1 32
One undress-suit.....	20 95	One hair pillow.....	33
One working-suit.....	2 41	One pair blankets.....	3 57
One overcoat.....	23 30	Two bedspreads.....	2 10
One rubber coat.....	4 54	Six sheets.....	3 66
One parade-cap.....	4 10	Four pillow-cases.....	1 00
One undress-cap.....	1 63	* One tooth-brush.....	23
* Two pairs high shoes.....	11 50	* One hair-brush.....	73
* Eight white shirts.....	11 04	* One whisk.....	17
* Two night-shirts.....	2 10	* One coarse comb.....	10
* Four under-shirts.....	2 24	* One fine comb.....	30
Twelve linen collars.....	1 68	One mug.....	10
* Eight pairs socks.....	2 00	* One cake soap.....	10
* Four pairs drawers.....	2 12	One soap-dish.....	10
* Six handkerchiefs.....	1 62	One requisition-book.....	30
* Eight towels.....	2 00	One laundry-hook.....	30
Two pairs drill-gloves.....	1 16	One pass-book.....	30
Two pairs Lisle-thread gloves.....	50	One stencil and ink; 1 brush.....	41
* One pair suspenders.....	38	* One thread-and-needle case.....	53
One neck-tie.....	50	One rug.....	1 55
Two clothes-bags.....	50	One wash-basin and pitcher.....	1 30
One hair mattress.....	6 75	One looking-glass.....	65

One water-pail	\$0 65	One broom	\$0 27
One slop-bucket	57		
Total			162 47

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home, but all other articles must conform to the regulations, and must, therefore, be supplied by the storekeeper.

Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of \$20, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, in the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of twenty dollars must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing	\$162 47
Deposit for books, &c	20 00
Total deposit required	182 47

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XV. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling expenses.

R. W. THOMPSON,
Secretary of the Navy.

EXAMINATION OF CANDIDATES FOR ADMISSION AS CADET-MIDSHIPMEN, 1879.

ARITHMETIC.

SEPTEMBER, 1879.—Time allowed, three hours.

1. Divide .0021362486 by .0215. Reduce 27 miles 5 furlongs 184 yds. to metres 1 metre = 39.37 inches. What per cent. of 11 lbs. 11 oz. 11 dwts. 8 grs. is 3 lbs. 5 oz. 17 dwts. 7 grs.?

2. Add together $47\frac{7}{8}$, $9\frac{1}{2}$, $16\frac{7}{10}$, and $\frac{1}{2}$.

Divide $\frac{2\frac{1}{2} + 3\frac{1}{2}}{3\frac{1}{2} - 2\frac{1}{2}}$ by $\frac{2\frac{1}{2} - 3\frac{1}{2}}{2\frac{1}{2} \times 3\frac{1}{2}}$.

Simplify $\frac{\frac{1}{2} + 2\frac{3}{4} + 9\frac{1}{6} - 3\frac{1}{2}}{\frac{1}{2} + 3\frac{1}{2} - 2\frac{3}{4} - \frac{1}{6}}$.

3. Find the square root of 34535.867 to three decimal places, and the cube root of .036 to five decimal places. Find what decimal part the square root of $\frac{31}{128}$ is of the square root of $\frac{1}{2}$.

4. Find the interest on £317 15s. 6d. for 93 days (30 days to a month) at $5\frac{1}{2}$ per cent per annum. A bank loans money for 30 days and charges 6 per cent. per annum for 33 days, collecting the interest in advance, and counting 30 days as a month; what rate per cent. per annum (365 days) does the bank actually receive? What ought to be paid for \$100 shares in a stock which pays 6 per cent. annual dividends in order that 8 per cent. may be made upon the investment?

5. A sum of £250 17s. 6d. is transmitted through Paris to New York—£1 = 24.75 francs; 9.2 francs = \$1.75; find the value of the sum in United States money. The value of a pound of gold is $15\frac{1}{2}$ times that of a pound of silver, and the weights of equal bulks of gold and silver are in the ratio of 17.2 to 10.5; find the value of a piece of silver which is equal in bulk to a \$20 gold piece.

ENGLISH BRANCHES.

JUNE 13, 1879.—Time allowed, three hours.

GRAMMAR.

I.

1. Give the principal parts of *behold*, *awake*, (to) *busy* (himself), *grow*, *burst*.
2. Inflect (or decline) *view*, *hue*, *pigmy*, *dwarf*.
3. What is a participle? an intransitive verb? the active voice? the potential mood?
4. Analyze: Instead, however, of answering the expectations raised with regard to the work on which it was supposed to rest, the foundation proved to be a wretched piece of brickwork.

II.

Parse the words in italics: We were roused as *soon* as the sun dawned by *Antag*, our *Greek* servant, with the news that the Pyramids were in *view*. *Never* will the *impression* made by their appearance be obliterated. By *reflecting* the sun's rays, they appeared as white as *snow*, and of *such* magnitude that *nothing* we had previously seen could have prepared us for them.

SPELLING.

Audible.	Extemporaneous.	Unforeseen.	Dynasty.
Perfumery.	Pertinacious.	Irrepressible.	Massacre.
Fundamental.	Apostle.	Epithet.	Elicited.
Disparagement.	Reality.	Discreet.	Parasite.
Patrician.	Prejudice.	Quarantine.	Novice.
Traitor.	Sustenance.	Fief.	Versatile.

GEOGRAPHY.

I. Describe the following rivers, telling where they rise, in what direction they flow, and into what water they empty; and state whether they form the boundary between different States or Territories, naming the States divided: 1, Orange River; 2, Red River; 3, Save River; 4, Vistula River.

II. Fix the position of the following towns, telling on what water they are situated: 1, Glasgow; 2, St. Paul de Loando; 3, Saragossa; 4, Rouen; 5, Omaha.

III. From what land, and into what water, do the following capes project?—Trafalgar, Gallinas, Bathurst, North Foreland.

IV. State what bodies of water are connected and what bodies of land separated by the following: 1, Niagara River; 2, Strait of Magellan; 3, Menai Strait; 4, Palk Strait.

V. Fix the position of the following mountains, and tell which of them are volcanoes: 1, Mt. Blanc; 2, Cotopaxi; 3, Hecla; 4, Everest.

VI. Name in order the States on the sea-coast of Europe, giving the capital of each.

RE-EXAMINATION.

ARITHMETIC.

SEPTEMBER, 1879.—Time allowed, five hours.

1. Divide .0073639619 by .000285847. Divide 99 miles 29 rods 2 feet 6 inches by 41, giving the result as so many miles, furlongs, &c. What decimal part of a year of 365½ days is 27 days 16 hours 29 minutes 4 seconds? (four decimal places).

2. Add together $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, and $\frac{6}{7}$, and subtract the result from $100\frac{1}{10}$.

Simplify $\frac{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}$.

To the product of $6\frac{1}{2}$, $7\frac{1}{2}$, and $8\frac{1}{2}$ add $3\frac{3}{4}$, and divide the sum by $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$.

3. Find the square root of 893830609. Find the square root of .025 to two decimal places. Find the cube root of $26-15\sqrt{3}$ to four decimal places.

4. A person buys bonds which pay 7.3 per cent. annual interest (par value \$100) at \$108; what rate of interest will he receive on his investment? At what rate per cent. is the deduction made when 19s. 10½d. is taken from an account of £39 15s. in consideration of immediate payment? Money being worth 5½ per cent. per annum, what is the present value of a note for \$3,750 due in three months?

5. When cloth is sold at \$1.37½ per yard, what is the corresponding price in francs per metre? 1 metre = 39.37 inches; \$1 = 5.25 francs. What is the weight of a cubic metre of water if 1 cubic foot weighs 1,000 ounces? (Give the weight in pounds.)

ENGLISH BRANCHES.

JUNE 16, 1879.—Time allowed, three hours.

GRAMMAR.

I.

1. Give the principal parts of *know, spend, wear, sit, set*.
2. Inflect (or decline) *verge, folly, belief, sheaf, child*.
3. Compare *gay, happy*. What is a pronominal adjective? Name the three and explain the different uses of each.
4. Analyze: The world is not solicitous to know whence proceeded the fault of an author, yet it may gratify curiosity to say that this book was written with the patronage of the great.

II.

Parse the words in italics: He *that* can *only* be *useful* on great occasions *and* without *exerting* his *abilities*, and *stand* a helpless *spectator* of a thousand *yet* which *fret* away *happiness*, and *which* *nothing* is required to *remove* but a little *desire* of conduct.

SPELLING.

Lateral.	Volley.	Sanitary.	Engineer.
Musician.	Delirium.	Development.	Efficiency.
Competition.	Leakage.	Benevolence.	Advantageous.
Necessary.	Glycerine.	Paralysis.	Feasible.
Machinery.	Abutment.	Intervene.	Wrought-iron.
Undeified.	Counterbalance.	Equipage.	Indispensable.

GEOGRAPHY.

- I. Where are the following places, and to what State do they belong?—1, Bourne; 2, Pondicherry; 3, Aden; 4, Jamaica; 5, Corsica.
- II. Name three principal rivers of France, telling where they rise, in what direction they flow, and into what water they empty. Name a city situated upon each of these rivers.
- III. Name *three* seaports on the west coast, *two* on the north coast, and *three* on the east coast of South America, telling in what State each of them is situated.
- IV. Name the Territories of the United States. Bound Nevada.
- V. Fix the position and direction of the following: 1, Carpathian Mountains; 2, Hartz Mountains; 3, Blue Ridge; 4, Altai Mountains.
- VI. How many States are there in the Union? Fix the position of the *highest* and tell on what water they are situated: 1, Trieste; 2, Kiel; 3, Cairo; 4, New York; 5, Harrisburg.

REGULATIONS

FOR THE

APPOINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

I. In pursuance of law, applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. The number of appointments which can be made is limited by law to twenty-five each year. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of good moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September for examination as to their qualifications for admission.

IV. The course of study will comprise four years at the Naval Academy, and two additional years at sea. All Cadets who finally graduate will be commissioned Assistant Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer while at the Naval Academy is \$500 per annum.

V. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the first degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition; geography; free-hand drawing; and an elementary knowledge of the principles governing the action of the steam-engine. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, shall have precedence for admission.

VI. The examination before the Medical Board is the same as that of candidates for appointment as Cadet-Midshipmen. See p. 49.

The following deposits must be made before a candidate can be received into the Academy:

For clothing (see p. 52).....	\$162 47
For books and drawing instruments.....	50 00
Total	212 47

VII. Persons who contemplate presenting themselves as candidates for admission as Cadet-Engineers are cautioned that the number of applicants is large, and the competition exceedingly close. It is, therefore, useless for candidates to present themselves unless well prepared on the subjects of the examination, and unless their physical qualifications are within the prescribed standard.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1879.

Number of competitors, 177.

ARITHMETIC.

Time allowed, three hours.

1. Add $\frac{1}{101}$ to the difference of .014 and $\frac{1}{100}$ and reduce the result to a decimal (six places). What per cent. of £31 17s. 4d. is £5 19s. 6d.? Reduce $.20\overline{83}$ (the 83 is repeated indefinitely) to a common fraction.

2. What will it cost to make a road 104 rods long and 60 feet wide, the land costing \$154 an acre, grading at the rate of \$200 a mile, and fencing one side at 50 cents a yard?

3. Find the square root of 324.00007625, and the value of $\frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}} - \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$, each to six places of decimals.

4. The French gramme is the weight of a cubic centimetre of water; a kilogramme is 1,000 grammes. Find the weight in kilogrammes of an anchor weighing 6,500 pounds, given that a cubic foot of water weighs 1,000 ounces, and the centimetre is .3937 of an inch.

5. In loaning money, banks deduct the interest, including the three days of grace, in advance. For what sum shall a person who wishes to use \$1,500 give his note for 60 days, interest 8 per cent. per annum? A person having a note for \$2,000 due at a bank, pays in \$200, and requests that a new note may be made at 90 days, the sum paid serving to pay the interest on the new note as well as to reduce his debt: for what sum shall the note be issued, the rate of interest being 8 per cent. per annum?

ALGEBRA.

Time allowed, three hours.

1. Reduce to their simplest forms the expressions:

$$\frac{x^2 + xy + y^2}{x^2 - xy + y^2} \times \frac{x^3 + y^3}{x^3 - y^3} \times \frac{(x - y)^2}{(x + y)^2}, \quad \frac{1}{(x - 1)(x + 1)} - \frac{2}{(x + 1)(x + 3)} + \frac{1}{(x + 3)(x - 1)}$$

and

$$\frac{x}{(x + y)(x + 2y)} + \frac{2y}{(x + y)(x + 3y)} + \frac{x}{(x + 2y)(x + 3y)} - \frac{2}{x + 3y}$$

2. Separate each of the following quantities into its simplest factors:

$$6x^2 + 5x - 6, \quad 8x^3 - 27y^3, \quad 9x^4 - 82x^2y^2 + 9y^4, \quad (x^2 + 4x)^2 - 2(x^2 + 4x) - 15,$$

and

$$2x^2 - 21xy - 11y^2 - x + 34y - 3.$$

3. Solve the equations:

$$\frac{2x - 1}{3} - \frac{3}{4}(x - 3) + \frac{4}{5}(3x - 8) = 25,$$

and

$$a(x - a) + b(x - b) + c(x - c) = 2ab + 2ac + 2bc,$$

$$a(x + y) + b(x - y) = c(x + y) + d(x - y) = 1.$$

4. Find the value of $\frac{\sqrt{a+x} + \sqrt{a-x}}{\sqrt{a+x} - \sqrt{a-x}}$ when $x = \frac{2ab}{b^2+1}$.

Given $x-y=7z$, and $x-z=4y$, find the value of $\frac{y-z}{x}$.

5. Solve the equation $\frac{x-1}{x-2} - \frac{x-2}{x-3} = \frac{x-5}{x-6} - \frac{x-6}{x-7}$.

A railway train runs a certain distance at a certain rate; had the rate been increased by a miles per hour, the distance would have been performed in $\frac{b}{c}$ of the time; but had the rate been diminished by a miles per hour, the time would have been increased by d hours: find the distance and the rate per hour.

GEOMETRY.

Time allowed, two hours and a half.

1. Prove that when two parallels are cut by a third straight line, the alternate interior angles are equal. Prove that the sum of the distances of any point from the three angles of a triangle is greater than the half sum of the sides. Show how to divide a given line into three equal parts.
2. Prove that if a series of parallels cutting any two straight lines intercept equal distances on one of the lines they also intercept equal distances on the other. Show how to find a mean proportional between two lines, and apply the method to construct a line $\sqrt{3}$ units in length.
3. Prove that in any triangle the square of a side opposite an acute angle is equal to the sum of the squares of the other two sides diminished by twice the product of one of these sides and the projection of the other upon that side. Show how to draw a tangent to a given circle through a given point not on the circumference.
4. Prove that in any triangle the product of two sides is equal to the product of the diameter of the circumscribed circle by the perpendicular let fall upon the third side from the vertex of the opposite angle. Show how to describe upon a line of given length a segment which shall contain a given angle.
5. Prove that the straight lines which bisect the vertical angles of all triangles on the same base, and on the same side of it, and having equal vertical angles, all pass through the same point. Show how to construct a triangle, given the base, the opposite angle, and the radius of the inscribed circle.

NATURAL PHILOSOPHY.

Time allowed, three hours.

1. A man rowing across a stream, which flows at the rate of 4 miles an hour, pulls directly toward the opposite bank at the rate of 3 miles an hour; find his actual velocity in miles per hour, and his time in crossing if the stream is one-half a mile wide.
2. If a body falling from rest describes 16 feet the first second, how far will it fall during the fourth second? The acceleration due to gravity being 32 feet per second, find the time in which a body falling from rest will acquire a velocity of 352 feet per second.
3. The height of a water-barometer being 34 feet, and that of a mercurial barometer 30 inches; find the specific gravity of mercury. If the height of a barometer rises from 30 inches to 30.25 inches, what is the increase in pressure in ounces per square foot? (a cubic foot of water weighing 1,000 ounces).
4. A body weighs in air 1000 grains, in water 300 grains, and in another liquid 440 grains; what is the specific gravity of the latter liquid? A body whose specific gravity is 3.5 weighs 4 pounds in water, what is its actual weight? What is the pressure in pounds per square inch on the cork of an empty bottle sunk 120 fathoms in water?

5. When an elevator is descending with an accelerated motion, how does the weight of a man compare with the pressure he exerts in standing upon it? How does weight compare with the pressure when the motion is uniform? (Give reasons for your answers.) How will a fall in the barometer affect the action of a siphon?

6. Ten men heave with a force of 75 pounds each, at as many capstan bars, from the axis of the capstan; the cylinder on which the hawser winds is 2 ft in diameter and the hawser 4 inches in diameter; find the tension of the hawser.

7. What weight of copper does a coin, contain which is a mixture of copper (specific gravity 8.5) with gold (specific gravity 17.5), and which weighs 123 grains in air and 112½ grains in water? Find the specific gravity of a mixture of 9 parts, by weight, of pure gold (specific gravity 19.4) with 1 part of copper.

8. A rope reeves through a single block, and both ends are made fast to a wall; a man fastens a stick to one part of the rope, sits upon it and pulls the rope below him; supposing that he weighs 150 pounds and can lift 150 pounds, what weight can he raise?

ENGLISH BRANCHES.

Time allowed, three hours.

ENGLISH GRAMMAR.

I. 1. Decline *box, enemy, journey, wreath*; 2. Give the past participle of *threaten, die, creep*.

II. Parse the words in italics:

*Many a night from yonder ivied casement ere I went to rest,
Did I look on great Orion sloping slowly to the west.*

SPELLING.

Ameliorate.	Smoulder.	Preceptor.	Semblance.
Certify.	Court-martial.	Adherent.	Sovereign.
Collision.	Guarantee.	Agreeable.	Infidel.
Allegiance.	Pamphlet.	Suicide.	Rhapsody.
Enamored.	Brilliant.	Literature.	Duchess.
Episode.	Miniature.	Flippancy.	Fascinate.

GEOGRAPHY.

1. Give the source, direction, and body of water at the mouth of, 1, Colorado; 2, Loire River; 3, Indus River; 4, Don River.

2. From what country and into what water do the following capes project? 1, Lopatka; 2, Bon; 3, San Lucas; 4, Wrath.

3. Fix the position of the following cities, and tell on or near what water they are situated: 1, Presburg; 2, Aberdeen; 3, Kingston; 4, Callao.

4. Fix the position and direction of the following mountains: 1, Carpathian; 2, Blue Ridge; 3, Caucasus.

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.*—Descriptions of all kinds of rope, and its practical manipulation for purposes on shipboard; measuring for and fitting standing and running rigging; tacking, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; the fittings of boats; the management of boats under various circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seamanship, with lectures and illustrations from models.

SHIP-BUILDING.

Text-books.—Thearle's Naval Architecture and Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and manœuvring of a fleet, under sail or steam.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

NAVAL TACTICS.*—Exercises in boats under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal Code.

PRACTICAL SEAMANSHIP.*—Exercises on board the United States sloop-of-war Dale every day mornings.

The instructor in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces;

Manufacture of wrought iron, steel, and bronze; fabrication of guns of all descriptions;

Manufacture of gunpowder and fuses, and of all kinds of projectiles and fire-works.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial,

terminal, and final velocities, and the methods of determining their values; the

effects of variations of charge, windage, and weight of projectiles; deviation of projectiles;

the several systems of pointing; tangent-sights and determination of their

range; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.*—Organization and formation of squad, company, and battalion; drill of the soldier; company and battalion drill, including instructions for skirmishes and the bayonet exercise.

Text-books.—United States Infantry Tactics; Wingate's Rifle Practice.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

HEAVY GUNS.—Exercises and target-practice on board the United States ship Santee.

ARTILLERY-PRACTICE.

FENCING.—Exercises with small-swords and broadswords.

*Cadet-Midshipmen only.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree, involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in geometry, and the application of the method, particularly to the projections of the sphere and to the construction of maps.

Text-books.—Ray's Higher Algebra;* Todhunter's Algebra for Beginners;† Chace's Geometry;* Wentworth's Geometry;‡ Chauvenet's Trigonometry; Church's Descriptive Geometry; Todhunter's Conic Sections;§ Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1879-'80:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with application to trigonometry and to geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and Schools; Todhunter's The Equations; Rice and Johnson's Elements of the Differential Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and description of marine steam-engines, and of instruments and apparatus used in connection with the computation of the power and its cost; instruction in the duties of the engine watch and of the engineer division, by means of practical exercises on board the United States steamers Nantucket and Mayflower under weigh.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, and the processes of manufacture, accompanied by practical exercises with the various methods and appliances for the conversion of the various materials into machinery.

DESIGNING OF MACHINERY.*—Pure mechanism, and the designing of boiler engines, including valve-gears.

MECHANICAL DRAWING.*—The nomenclature of design; general and conventional practices of the art; the execution of plans, elevations, and sections; isometric projections; shades, shadows, and linear perspective.

PRACTICAL EXERCISES.—The management of marine steam apparatus; [the use of tools and machines; hand-work of the machine-shop, pattern-shop, smithery, and foundry.]*

Text-books.—Weisbach's Mechanics of Engineering, Vol. II; Northcott's Steam Engine; Warren's Elements of Mechanical Drawing; Willis's Principles of Mechanism; Rankine's Steam-Engine and other Prime Movers; Zeuner's Valve-Motion, andoley's Workshop Appliances; King's Lessons and Notes on the Steam-Engine.

* Cadet-Engineers only.

† Cadet-Midshipmen only.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments especially those used for determining terrestrial latitudes and longitudes.

Books.—C. J. White's *Astronomy*; *Theory of the Portable Transit and the Telescope*.

NAVIGATION.*—Theory and practice of navigation, the latter including instruction in duties of the navigator, the use of navigating instruments, and their construction with the solution of problems and the use of tables.

Books.—Coffin's *Navigation*; Howell's *Mathematical Theory of the Deviations of the Compass*; Bowditch's *Navigator*; Howell's *Marine Surveying*.

SURVEYING.*—The form of the earth, with special reference to the construction of maps; explanation of geodetical surveys; the solution of problems in nautical surveying, and practical work in surveying and constructing charts.

Book.—Howell's *Marine Surveying*.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

Acoustics.—Theory of waves; the production and propagation of sound; the natural evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

Optics.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Statical electricity; dynamical electricity; magnetism; electro-magnetism; electrical measurements; thermo-electricity; applications of electricity.

CHEMISTRY.—General chemistry.

EXPERIMENTAL LECTURES IN PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; effects of heat; instruments used for the measurement of heat; thermodynamics.

PHYSICAL MEASUREMENTS.†—In this course the Cadets are permitted to elect between work in the physical laboratory and work in the chemical laboratory.

The work in the physical laboratory during the year 1878-79 consisted in determining specific and latent heat; the comparison of several methods of determining hygrometric state of the atmosphere; the determination of specific gravities; the determination of heat conductivity; the determination of the electro-motive force and resistances of batteries; an original investigation of the changes of electrical resistance in some substances due to changes of pressure; the resistance of metallic wires; an original investigation of the electrical resistance of boiler-scale; the determination of the dip, declination, and intensity of the earth's magnetism; the use of the spectroscope and of the spectrometer; the determination of the indices of refraction; experiments in tempering steel, and experiments on the torsional and tensile strength of wires.

The work in the chemical laboratory during the year 1878-79 embraced blowpipe analysis; crystallography; mineralogy; quantitative analysis.

The course in mineralogy comprised the study in the mineral cabinet of the most commonly recurring minerals, the useful ores, and the objectionable minerals which are usually associated with them.

The course in quantitative analysis consisted of the gravimetric determination of iron in ammonio-ferrous sulphate.

and tin in gun-metal.

per, antimony, and zinc in "white brass."

and lead in solder.

*Cadet-Midshipmen only.

†Cadet-Engineers only.

Lead, carbon dioxide, and insoluble residue in a white lead ground in oil.
Valuation of a coal.

The preparation and standardizing of a solution of potassia permanganate by means of iron wire, ammonio-ferrous sulphate, oxalic acid, and ammonic oxalate.

The estimation of iron in an iron salt, and in hematite and magnetite ores by means of the permanganate solution.

Preparation and standardizing of a solution of potassia dichromate.

Estimation of iron in an iron salt by Penny's method.

Text-books.—Stewart's Elementary Physics; Eliot and Storer's Chemical Analysis; Jenkins's Magnetism and Electricity; Stewart's Elementary Treatise on Heat; Miller's Inorganic Chemistry; Kohlrausch's Physical Measurements; Nason and Chandler's Blowpipe Analysis; Dana's Manual of Mineralogy; Thorpe's Quantitative Chemical Analysis.

Cadet-Engineers of the first class have additional practical exercises in chemical analysis every Saturday morning, while the Cadet-Midshipmen exercise in seamanship.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima and the tracing of curves; the methods of integration and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to simple cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriiform fluids*.—Laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

THE STRENGTH AND RESISTANCE OF MATERIALS.*—Simple and compound stress; the relations between strain and stress; the strength and stiffness of beams; beams of uniform resistance.

THE METHOD OF LEAST SQUARES.*—The theory of the method of least squares and the application of the method to results derived from experiments.

THEORETICAL NAVAL ARCHITECTURE.*

Text-books.—Rice and Johnson's Differential Calculus; Williamson's Integral Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; Rankine's Applied Mechanics; Merriman's Method of Least Squares; Wilson's Theoretical and Practical Ship-Building.

ELECTIVE COURSES.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in integral calculus and in analytical mechanics.

The course in Theoretical Naval Architecture is elective for Cadet-Midshipmen. There is also an elective course in Theoretical Naval Architecture for Cadet-Engineers.

Text-books.—Williamson's Integral Calculus, and Tait and Steele's Dynamics of a Particle; Lectures on the Mathematical Theory of Naval Architecture.

* Cadet-Engineers only.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

W.—Constitution of the United States.

International law:—rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii*; rights and duties of neutrals; contraband; blockade; right of search; ship's papers; offenses against the law of nations.

Principles of maritime law.

Lectures.

—books.—Woolsey's International Law; Andrews's Manual of the Constitution.

History.—Outlines of history, especially the history of Greece and Rome, and of the states of Western Europe down to 1875; historical geography; progress of colonial settlement in America; history of the United States; naval history; lectures.

—books.—Freeman's General Sketch of History, with Labberton's Historical Geography; Eliot's History of the United States, with modern atlases.

Rhetoric and Composition.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercise in the composition of themes and official reports.

—book.—Bain's Rhetoric.

English.—Historical development of the English language; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology. Synonymy. Analysis of sentences.—Readings from standard authors. Classification of words; derivation of words by usage and by derivation; synonyms; laws of change in the meaning of words.—Faults in diction, and their remedies; selection and arrangement; logical principles of reasoning.

—books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

French and Spanish Languages.—Grammar; exercises in reading, writing, and conversation.

—course in Spanish is elective.

—books.—Keutel's French Grammar; La Fontaine's Fables; Prud'homme's French Proverbs; Erckmann-Chatrian's *Le Conscrit* and *Waterloo*; Gasc's Dictionary; Gasc's Spanish Manual; Tolon's Reader; Barretti's Dictionary.

DEPARTMENT OF DRAWING.

Outline drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are arranged in classes, each class pursuing the course for the corresponding year.

PROGRAMME OF RECITATIONS.

The time devoted to daily recitations is divided into three periods, indicated thus:—(1), (2), (3), denotes first period, from 8.20 a. m. to 10.20 a. m.; (2) denotes second period, from 10.35 a. m. to 12.35 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m.

Practical exercises begin on Saturdays at 8 a. m. from October 1 to December 15, and from 22 to June 1; and at 10.45 a. m. from December 15 to March 10. On other days, except Sundays, exercises begin at 4 p. m.

FIRST TERM.

From October 1, 1879, to February 1, 1880.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Seamanship.....	M. (3)	Seamanship.
Mathematics.....	M. T. W. Th. F. (2) S. (1)	{ Algebra and Geometry
English Studies, History, and Law.....	M. T. W. Th. F. (1)	{ Elective course once a week
Modern Languages.....	1st division, T. Th. (3).....	English and History.
Drawing.....	2d division, W. F. (3).....	Keetel's French Grammar
	1st division, W. F. (3).....	elective course in Spanish
	2d division, T. Th. (3).....	Free-hand drawing.
THIRD CLASS—SECOND YEAR.		
Seamanship.....	W. (3)	Seamanship.
Mathematics.....	M. T. W. Th. F. (1).....	Trigonometry.
English Studies, History, and Law.....	F. (3)	Elective course once a week
	M. T. Th. (3).....	Descriptive Geometry.
Modern Languages.....	M. W. F. (2).....	English and History.
Drawing.....	T. Th. (2) S. (1)	French, and Elective course
		Spanish.
		Topography.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	Th. (3).....	Luce's Seamanship.
Ordnance and Gunnery.....	F. (3)	Infantry Tactics and Orders
Astronomy, Navigation, and Surveying.....	M. (2) T. (3)	Instructions.
		Astronomy.
Mechanics and Applied Mathematics.....	M. T. W. Th. F. (1)	Calculus.
English Studies, History, and Law.....	One period a month. W. (2).....	Elective course twice a week
Modern Languages.....	M. (3) Th. (2)	English studies.
Physics and Chemistry.....	T. F. (2) W. (3) S. (1).....	French, and Elective course
		Spanish.
		Chemistry and Electricity.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	T. (3) F. (1).....	Ship-building.
Ordnance and Gunnery.....	M. W. (2)	Luce's Seamanship.
Steam-engineering.....	Th. S. (1) F. (2)	Ordnance and Arms.
Astronomy, Navigation, and Surveying.....	W. Th. F. (3)	Marine Engines.
Physics and Chemistry.....	M. T. W. (1)	Navigation.
Modern Languages.....	M. (3) Th. (2)	Electricity.
	T. (2)	French, and Elective course
		Spanish.

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
cs	M. T. W. Th. F. (2) S. (1)	Algebra and Geometry. Elective course once a week. Mechanical Drawing, and Fabrication of Machinery. English and History. Keetel's French Grammar, and elective course in Spanish.
neering	M. T. Th. (3)	
udies, History, and Law nguages	M. T. W. Th. F. (1)	
	W. F. (3)	
THIRD CLASS—SECOND YEAR.		
cs	M. T. W. Th. F. (1)	Trigonometry and Descriptive Geometry. Elective course once a week. Descriptive Geometry. Mechanical Drawing, and Fabrication of Machinery. English and History. French, and Elective course in Spanish.
neering	F. (3)	
udies, History, and Law nguages	T. Th. (2) W. (3) S. (1)	
	M. T. Th. (3)	
	M. W. F. (2)	
SECOND CLASS—THIRD YEAR.		
neering	M. (2) T. Th. F. (3)	Mechanical Drawing, Marine Engines, and Fabrication of Machinery, Calculus. Elective course twice a week. English studies. French and elective course in Spanish. Chemistry and Heat.
and Applied Mathe- udies, History, and Law nguages	M. T. W. Th. F. (1)	
	One period a month. W. (2)	
d Chemistry	M. (3) Th. (2)	
	T. F. (2) W. (3) S. (1)	
FIRST CLASS—FOURTH YEAR.		
neering	T. (3) F. (1)	Ship-building. Marine Engines, Fabrication and Designing of Machinery, and Mechanical Drawing. Electricity.
	M. T. W. Th. S. (1) W. Th. F. (3)	
Chemistry	M. (3) Th. (2)	Strength of Materials. French, and Elective course in Spanish.
and Applied Mathe- nguages	M. W. F. (2)	
	T. (2)	

SECOND TERM.

From February 1, 1880, to June 1, 1880.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
	M. (3).....	Seamanship.
	M. T. W. Th. F. (2) S. (1).....	Algebra and Geometry.
		Elective course once a week.
Mathematics, History, and Languages	M. T. W. Th. F. (1).....	English and History.
	1st division, T. Th. (3).....	French, and elective course
	2d division, W. F. (3).....	in Spanish.
	1st division, W. F. (3).....	Topography.
	2d division, T. Th. (3).....	
THIRD CLASS—SECOND YEAR.		
	Th. (3).....	Seamanship.
	M. T. W. Th. F. (1).....	Analytical Geometry.
		Elective course once a week.
Chemistry	F. (3).....	Descriptive Geometry.
Mathematics, History, and Languages	T. (3) Th. (2) S. (1).....	Elementary Physics.
	M. W. (3) T. (2).....	English and History.
	M. W. F. (2).....	French, and Elective course in Spanish.

CADET-MIDSHIPMEN—Continued.

Departments.	Periods.	Subjects.
SECOND CLASS—THIRD YEAR.		
Seamanship.....	W. F. (3).....	Luce's Seamanship.
Ordnance and Gunnery.....	Th. (2).....	Naval Tactics.
	T. Th. (3).....	Infantry Tactics and Fire Instructions.
Astronomy, Navigation, and Sur- veying.....	F. (2).....	Astronomy.
Mechanics and Applied Mathe- matics.....	M. T. W. Th. F. (1).....	Mechanics.
English Studies, History, and Law	One period a month.....	Elective course twice a month.
Modern Languages.....	M. (3) T. (2) S. (1).....	English studies.
		French, and Elective course Spanish.
Physics and Chemistry.....	M. W. (2).....	Heat.
FIRST CLASS—FOURTH YEAR.		
Seamanship.....	M. W. (2).....	Luce's Seamanship.
Ordnance and Gunnery.....	W. (3) F. S. (1).....	Ordnance and Armt.
Steam-engineering.....	M. Th. (3) T. (2).....	Marine Engines.
Astronomy, Navigation and Sur- veying.....	M. T. W. Th. (1).....	Navigation and Surveying.
Mechanics and Applied Mathe- matics.....	T. (2).....	Elective course in Mech- anics.
English Studies, History, and Law.	T. F. (3).....	Public Law.
Physics and Chemistry.....	F. (2).....	Electricity.
Modern Languages.....	Th. (2).....	French, and Elective course Spanish.

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Mathematics.....	M. T. W. Th. F. (2) S. (1).....	Algebra and Geometry.
	M. (3).....	Elective course once a month.
Steam-engineering.....	W. F. (3).....	Descriptive Geometry.
English Studies, History, and Law	M. T. W. Th. F. (1).....	Mechanical Drawing.
Modern Languages.....	T. Th. (3).....	English and History.
		French, and Elective course Spanish.
THIRD CLASS—SECOND YEAR.		
Mathematics.....	M. T. W. Th. F. (1).....	Analytical Geometry and Descriptive Geometry.
	F. (3).....	Elective course once a month.
Steam-engineering.....	Th. (3).....	Descriptive Geometry.
Physics and Chemistry.....	T. (3) Th. (2) S. (1).....	Mechanical Drawing.
English Studies, History, and Law	M. W. (3) T. (2).....	Elementary Physics.
Modern Languages.....	M. W. F. (2).....	English and History.
		French, and Elective course Spanish.
SECOND CLASS—THIRD YEAR.		
Astronomy, Navigation, and Sur- veying.....	Th. (2) F. (3).....	Descriptive Astronomy.
Steam-engineering.....	T. W. Th. (3) F. (2).....	Mechanical Drawing and Calculation of Machinery.
Physics and Chemistry.....	M. W. (2).....	Marine Engines.
Mechanics and Applied Mathe- matics.....	M. T. W. Th. F. (1).....	Heat.
English Studies, History, and Law	One period a month.....	Mechanics.
Modern Languages.....	M. (3) T. (2) S. (1).....	Elective course twice a month.
		English studies.
		French, and Elective course Spanish.
FIRST CLASS—FOURTH YEAR.		
Steam-engineering.....	M. T. W. Th. F. (1) T. (2) Th. (3).....	Marine Engines, Tables and Designing of Machinery and Mechanical Drawing.
Physics and Chemistry.....	M. W. (3) F. (2).....	Physical Measurements and Electricity.
Mechanics and Applied Mathe- matics.....	M. W. (2) S. (1).....	The Method of Least Squares Naval Architecture.
English Studies, History, and Law	T. F. (3).....	Elective course in Mech- anics.
Modern Languages.....	Th. (2).....	Public Law.
		French, and Elective course Spanish.

EXAMINATION PAPERS—1878-79.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—Time allowed, five hours.

[Two questions may be omitted.]

Simplify $a(b+c)(b^2+c^2-a^2)+b(a+c)(a^2+c^2-b^2)+c(a+b)(a^2+b^2-c^2)$.

Multiply $\frac{x+\sqrt{y}}{x-\sqrt{y}} - \frac{x^2+y-x\sqrt{y}}{x^2+y+x\sqrt{y}}$ by $\frac{x-\sqrt{y}}{x+\sqrt{y}} - \frac{x^2+y+x\sqrt{y}}{x^2+y-x\sqrt{y}}$.

Reduce $1 - \left\{ \frac{a^2+b^2-c^2-d^2}{2(ab+cd)} \right\}^2$ to the form of a fraction and separate the numerator into four factors. Find the *g. c. d.* of $px^3 - (p-q)x^2 + (p-q)x + q$, and $(p+q)x^2 + (p+q)x - q$. If $\frac{x+a}{a} = \frac{m}{n}$, what is the value of $\frac{x+a}{x-a}$?

Find the product of $x+y+z^{\frac{1}{2}} - 2y^{\frac{1}{2}}z^{\frac{1}{2}} + 2z^{\frac{1}{2}}x^{\frac{1}{2}} - 2x^{\frac{1}{2}}y^{\frac{1}{2}}$, and $x+y+z^{\frac{1}{2}} + 2y^{\frac{1}{2}}z^{\frac{1}{2}} - x^{\frac{1}{2}} - 2x^{\frac{1}{2}}y^{\frac{1}{2}}$. Divide $a^3+8b^3+27c^3-18abc$ by $a^2+4b^2+9c^2-2ab-3ac-6bc$.

Express $\frac{1}{\sqrt{2}+\sqrt{3}+\sqrt{5}}$ with a rational denominator.

Simplify $\sqrt{a+b+c+2\sqrt{ac+bc}}$, and $\frac{7+\sqrt{-3}}{2-\sqrt{-3}} + \frac{8+3\sqrt{-3}}{2+\sqrt{-3}} - \frac{4(2-\sqrt{-3})}{1-\sqrt{-3}}$.

The equation $x^2+y^2+Ax+By+C=0$ is satisfied when $x=15, y=10$, when $x=4, y=3$, and when $x=6, y=7$. Find A, B , and C .

Solve the equations $\frac{1}{2}\left(x-\frac{51}{26}\right) - \frac{1}{13}(2-6x) = x - \frac{1}{39}\left(5x - \frac{10-3x}{4}\right)$, and

$$\sqrt{y} - \sqrt{y-x} = \sqrt{20-x}, \quad \sqrt{\frac{y-x}{20-x}} = \frac{3}{2}.$$

Solve the equations $x^2+17x-18=0$, $(x+7)^{\frac{1}{3}} + \frac{3}{4}(x+7)^{\frac{1}{2}} = 5$, and

$$\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = \frac{10}{3}, \quad x+y=10.$$

Given $(y-2x)(y^2-x^2) - a(y-x)^2 + 4a^2(x+y) - a^3=0$, find x and y , (1) when $a=1$, (2) when $y=2x+\frac{a}{3}$, (3) when $y=-x+\frac{2a}{3}$.

Find x and y from $x^4+y^4=3x^2y^2+2xy+1$, $x^3+y^3=2xy^2+2y^2+x+1$.

Find the value of $\frac{(a^3-3a)(x^2-y^2)+2xy(1-3a^2)}{(1-3a^2)(y-xz)(y-ax)}$, given

$$y=x \frac{a+\sqrt{3}}{1-a\sqrt{3}}, \quad z = \frac{a-\sqrt{3}}{1+a\sqrt{3}}.$$

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, three hours.

[One question may be omitted.]

1. Write five terms of the expansion of $(x+y)^n$. Expand $(2x+3y)^4$, and $(x+\sqrt{2})^5$. Expand $(a^3-x^3)^{\frac{1}{2}}$ to five terms and use the result to find $\sqrt[3]{999}$ to five decimals.

2. Find five terms of $\sqrt{1+x+x^2+x^3}$ by means of indeterminate coefficients. Separate $\frac{x^3-x^2-x-1}{x(x^2-1)(x^2-9)}$ into five fractions with denominators of the first degree.

3. Define a logarithm, and the terms *base*, *characteristic*, *mantissa*, *modulus*. Find the value of each of the following expressions by means of logarithms: $(.027562)^{\frac{1}{2}}$, $\frac{.0034789}{.000075634}$, x^x when $x=3.1416$, and also when $x=.031416$.

4. Find the value of the expression $\left\{ \frac{a^3 b^2 c^3 d}{e^2 f^2 g} \right\}^{\frac{1}{2}}$, given $a, 386.07$; $b, .00078568$; $d, 99878000$; $e, 432750$; $f, .000064852$; $g, 22755$.

5. Form an equation whose roots are $2 \pm \sqrt{5}$ and $3 \pm \sqrt{-1}$. Find what relation $x^4-12x^3+54x^2-30x+1=0$ becomes (1) when it is deprived of its third term, (2) when its roots are increased by 2, (3) when its roots are doubled. Find what relation the equation $x^4-18x^3-60x^2+x-2=0$ becomes when the third term is removed. Find the roots of the equations $x^4-3x^3-15x^2+19x+30=0$ and $x^5-4x^4+x^3+x^2-4x+4=0$.

6. Eliminate y between the two equations

$$\left. \begin{aligned} ay^2+by+c &= 0 \\ a_1y^2+b_1y+c_1 &= 0 \end{aligned} \right\}$$

Apply the result to eliminate m between the equations

$$\left. \begin{aligned} (x^2-y^2)m^2+a(x+y)m+a(x-y) &= 0 \\ (x^2+y^2)m^2+a(x-y)m-a+(x-y) &= 0. \end{aligned} \right\}$$

GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, three hours.

[One question may be omitted.]

1. Prove that the sum of the angles of a triangle is two right angles; that a line parallel to the base bisecting one side of a triangle bisects the other side, and is equal to one-half the base, and in a right triangle that the line drawn from the vertex of the right angle to the middle of the hypotenuse is equal to one-half the hypotenuse.

2. Prove that the medial lines of a triangle meet in a point; construct a triangle from two sides and an angle opposite one of them. Discuss this case, showing when there is one solution, when two, and when none. Draw a common interior tangent to two circles, and prove the construction.

3. Prove that in any circumscribed quadrilateral the sum of two opposite sides is equal to the sum of the other two. State a proposition by means of which we can construct a mean proportional between two lines. How would you construct a line in length? Prove that if in any triangle a medial line is drawn from the vertex to the base, (1) the sum of the squares of the two sides is —, (2) the difference of the squares of the two sides is —, and that in any quadrilateral the sum of the squares of the four sides is —.

4. Show how to inscribe the following regular polygons in a circle: square, (proof), decagon (proof). The radius being a , find the length of a side of the triangle, square, octagon, and decagon.

5. Prove that the volume of any parallelepiped is equal to the product of the base and altitude; that a triangular pyramid is one-third of a prism of the same base and altitude.

and that the frustum of a triangular pyramid is equivalent to the sum of ramids, &c. (State the proposition in full.)

and $O B$ are at right angles, $O A=a$, $O B=b$. Draw $O C P$ perpendicular to meeting $A B$ at C , and make $C P=A C$, draw $P Q$ parallel to $O A$, meeting O . It is required to find expressions for $O Q(x)$ and $P Q(y)$ in terms of a and prove that if $A B=c$, then $(x^2+y^2)^2=c^2 x^2(x+y)^2$.

THEORY OF EQUATIONS.

ELECTIVE COURSE.

JUNE, 1879.—Time allowed, two hours.

Shipmen Lewis Nixon and W. T. Paine. Cadet-Engineers W. H. P. Creighton and Emil Theiss.

re the equation $x^3+qx+r=0$. What is the relation between q and r when ion of the above form has equal roots? Prove that the condition which must order that $ax^3+bx^2+cx+d=0$ may have equal roots is

$$(9ad-bc)^2-4(b^2-3ac)(c^2-3bd)=0.$$

re the equation $x^4+qx^3+rx+s=0$, and apply the method used in your solu- and the roots of the equation $x^4+8x^3+20x^2+19x+12=0$.

l a root of the equation $x^4-6x^3+5x^2+14x-4=0$ to five decimal places.

ce the loci of the equations $y^2=ax$, $y^3=a^2x$, $x^3+a^4y=0$, $2y^5-10xy^3+15x^2=0$, $xy^2+a(4x^2-y^2)=0$.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—Time allowed, four hours.

Name the foreign elements in the English language in the order in which nence was exerted.

scribe the circumstances which led to any one of these influences, and charac- elly its effect on the language.

plain the terms: 1. Welsh; 2. England; 3. Briton; 4. Norman; 5. Analytic a language; 6. Langue d'oïl; 7. Revival of letters.

Classify the tenses of the verb according to the time and character of the pressed.

re the possessive singular and plural of *glass*, *reef*, *goose*, *play*, *Hindoo*, *seraph*, *c*, *sheaf*, *pulley*. Explain the origin of the possessive-case ending.

) Explain the gradual simplifying of the order of words in a sentence, in the of the language.

re an account of the spoken and written language of England from 1066 to That is the significance of the latter date?

plain the case of extension.

alyze the following:

- (1) Oh, who can tell, save he whose heart hath tried,
- (2) And danced in triumph o'er the waters wide,
- (3) The exulting sense—the pulse's maddening play,
- (4) That thrills the wanderer of that trackless way;
- (5) That seeks what cravens shun with more than zeal,
- (6) And where the feebler faint, can only feel—
- (7) Feel—to the rising bosom's inmost core
- (8) Its hope awaken and its spirit soar!

V. (a) Explain the comma after *Oh* (1) and *tell* (1); the dashes in (3), (6), and the semicolon in (4).

(b) Classify the following and explain their formation: *Maddening*, (3); *truer* (4); *inmost* (7); *awaken* (8). Explain the force of *er* in *feebler*; in the second *er* of *wanderer*; in the third syllable.

(c) Explain the words *that* and *what* as they occur in (4) and (5).

VI. "As the news spread, a moment later, squares and market-places broke forth in acclamations. Yet were the rejoicings *less strange* than the *weeping*. For the *best* of men had been wound up to *such a point that*, at length, the stern English were so *little used* to outward emotion, gave way, and *thousands* sobbed *aloud* for very grief. Never within the memory of the oldest, not even on *that night* when it was known that the army had declared* for the Parliament, had *there* been such rejoicings." Explain the construction of the words in italics.

VII. (a) Explain formation of news, market-places, outward, oldest.

(b) Give principal parts of all the verbs in VI, except those starred, explaining and classifying all the forms.

HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—Time allowed, four hours.

1. Give the geographical position of the following nations, and state to what races they belong: 1. Phœnicians; 2. Bulgarians; 3. Magyars; 4. Lithuanians; 5. Roumanians; 6. Basques.

2. State the three titles borne by Charles the Great before he was emperor, and how he got each of them. What was the ground of Charles's claim to be Roman emperor?

3. Who were the Patricians? How was their power reduced? Describe the changes that succeeded to their position in the commonwealth, and show how the existing class tended to keep the government aristocratic. What is meant by saying that the establishment of the Empire was not a formal revolution?

4. Connect the following dates, stating briefly the historical significance of the events referred to in the series: 622, 632, 710, 732, 1099, 1187, 1291, 1453, 1492, 1571.

5. What was the German feeling in regard to towns? How was this illustrated in Britain? How was this feeling afterwards changed, and what brought about the change?

6. Describe the origin of the United Provinces, and show how they became the chief powers of Europe.

7. State the circumstances that gave rise to the League of Cambray. State the extent of the dominions of Charles V., and show by a genealogical table how he came into possession of each of them.

8. Explain the origin and meaning of the following names: 1. Lorraine; 2. Bengal; 3. Iconoclast; 4. Dauphin; 5. Sultan of Rome; 6. King of the Romans; 7. Caliph.

9. "For the very reason that the French Kings had once had much less power than the Emperors or the English Kings, they came in the end to have much more than either of them." Explain fully, showing what effect the feudal system had on the popular assemblies in different states of Europe.

10. Draw a map of Europe at the end of the Vth Century, putting down the boundaries of the Roman Empire, Kingdoms of the Franks, Burgundians, East-Goths, West-Goths, and the following places: Toledo, Ravenna, Toulouse, Tours, Nice, Aachen, Trier, Arles, Avignon, Pisa, Basel, Byzantium, Hadrianople; and the following rivers: Danube, Rhone, Elbe, Rhine, Ebro, Loire, Po, Weser, Seine.

HISTORY OF THE UNITED STATES.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, four hours.*

1. Explain tariff, protection, excise, strict constructionist, Monroe doctrine, Hartford convention.
2. State the form of government in each colony at the Revolution, and give a brief account of each of the prevailing forms.
3. Explain the terms "Federal" and "Republican" as applied to the Government of the United States, and show that these two principles have a historical basis.
4. What were the Articles of Confederation? When were they in operation? What were their defects?
5. Give some account of (1) Webster-Ashburton treaty, (2) Alabama claims, (3) French war of 1798.
6. Explain the Navigation Acts and their object.
7. Give an account of the battle of Gettysburg, and the circumstances which preceded and followed it.
8. The treaty with France in 1778; by whom was it brought about, and what were its results?
9. Show how and when the Massachusetts charter was lost, and in what form it was recovered.
10. Draw a map of the Louisiana cession of 1803, and of the territory from which slavery was excluded by the Missouri Compromise.

ENGLISH.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, four hours.*

- I. Discuss the value of arguments from analogy.
- II. In what way and with what limitations may speech be said to be the guide to written prose?
- III. Explain personal metaphor, fine writing, partial induction, novel and romance, essentials and accidents.
- IV. Show by the method of elimination the difference in meaning of the following words: Expedient, convenient, opportune.
- V. Explain the formation of the words *interval* and *camp*, showing what law of change each illustrates.
- VI. Correct and point out the faults in the following: "I expect my folks lives most all of nine miles from Lake Erie; it's sort of lonesome out there, but it ain't a great ways to go for an individual raised in Maine, and I'd as lives go as not."
- VII. "By making the same man a capitalist and a workman, coöperation enables him to understand the difficulties of an employer's position." Supply what is wanting, put in the form of a syllogism, and point out the various premises and terms.
- VIII. "The Lord Chancellor had been guilty of criminal laxity in office, but this was explained by the immense demands of his position, and atoned for by the special labors he had undertaken." Put in the form of a syllogism, explain the error, and draw a diagram.
- IX. Explain the figures in the following passage, and expand, as far as they admit of expansion:

"What are thine hopes, Humanity?—thy fears?
 Poor voyager, upon this flood of years,
 Whose tide, unturning, hurries to the sea
 Of dark unsearchable eternity;
 The fragile skiffs, in which thy children sail
 A day, an hour, a moment, with the gale,
 Then vanish:—gone like eagles on the wind,
 Or fish in waves, that yield and close behind?
 Thine hopes,—lost anchors buried in the deep,
 That rust, through storm and calm, in iron sleep."

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, four hours.*

Translate into French the following sentences :

1. Tell me what you know of Robert Fulton's history. When and where was he born ?
2. Robert Fulton was born in the United States in 1765.
3. He was, without doubt, the child of rich parents ?
4. On the contrary, his parents were very poor.
5. How did he begin life ?
6. As soon as he knew how to read and write, he was placed in apprenticeship to a jeweler's.
7. And later ?
8. Later he started for England and studied mechanics.
9. They say that he invented many things ?
10. Yes, from that time he invented incessantly.
11. Have his inventions been adopted ?
12. Later his inventions were adopted and put in practice by America and England.
13. Why do you say "later" ?
14. Because at first the public and the English Government did not pay much attention to it.
15. In presence of this difficulty, what did Fulton do ?
16. Hoping to find more encouragement in France, he crossed the channel and arrived in Paris in 1796.
17. With what did he occupy himself in France ?
18. He worked for several years at a new war engine invented by himself.
19. Without doubt the government aided him ?
20. At first the government gave him help, then forsook him.
21. It was that which assuredly decided him to leave France ?
22. Yes, but he met one of his countrymen, who lent him funds.
23. How did he employ that money ?
24. He built a large steamboat.
25. Was it a success ?
26. Without doubt. He proved it successful in 1803.
27. What did those who saw the experiment do ?
28. They were not long in forgetting it.
29. This is very astonishing ; how can you explain it ?
30. It was at the time Napoleon was so victorious, when all France was celebrating her Emperor.
31. Very well. But I suppose Fulton could not have been very well satisfied with what he did then ?
32. He returned to America and built a new steamboat.

GRAMMAR.

Give the plural of the following nouns :—

- I. Those ending in the singular in *s*, *x*, and *z*.
- II. Nouns ending in *au* or *eu*.
- III. Nouns ending in *al*.
- IV. Give the feminine of the adjectives *heureux*, *bon*, *fou*, *content*.
- V. Explain the rule about *vingt*, *cent*, and *mille*.

- How do adjectives agree with the nouns qualified ?
 What is the place of the adjectives in French ?
 Give some of the adjectives which do not follow the general rule.
 How many articles are there in French ?
 How many genders are there ?
 Is there any rule for distinguishing gender ?
 Explain what is meant by "a partitive sense".
 Explain the use of *à*, *dans*, and *en*.
 Give in a table—
 (a) The present indicative, first person singular and plural,
 (b) The imperative, second person singular,
 (c) The present subjunctive, third person singular and plural,
 (d) The future first and second person singular,

être, partir, devoir, and venir.

Translate the following into English :

LES AVENTURES DE TÉLÉMAQUE. LIVRE PREMIER.

Calypso ne pouvait se consoler du départ d'Ulysse. Dans sa douleur, elle se trouvait malheureuse d'être immortelle. Sa grotte ne résonnait plus de son chant, les dieux qui la servaient n'osaient lui parler. Elle se promenait souvent seule sur les bords fleuris dont un printemps éternel bordait son île ; mais ces beaux lieux, loin de lui adoucir sa douleur, ne faisaient que lui rappeler le triste souvenir d'Ulysse, qu'elle y avait vu tant de fois auprès d'elle. Souvent elle demeurait immobile sur le rivage de son île, qu'elle arrosait de ses larmes ; et elle était sans cesse tournée vers le côté où son vaisseau d'Ulysse, fendait les ondes, avait disparu à ses yeux.

Un jour, tout-à-coup elle aperçut les débris d'un navire qui venait de faire naufrage ; des débris de rameurs mis en pièces, des rames écartées çà et là sur le sable, un gouvernail, et des cordages flottant sur la côte. Puis elle découvrit de loin deux hommes, l'un paraissait âgé ; l'autre quoique jeune, ressemblait à Ulysse. Il avait sa stature et sa fierté, avec sa taille et sa démarche majestueuse. La déesse comprit que c'était Télémaque, fils de ce héros ; mais, quoique les dieux surpassent de loin en puissance tous les hommes, elle ne put découvrir qui était cet homme vénérable. Télémaque était accompagné. C'est que les dieux supérieurs cachent aux hommes tout ce qui leur plaît, et Minerve, qui accompagnait Télémaque sous la figure d'un vieillard, ne voulait pas être connue de Calypso.

THIRD CLASS.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, five hours.*

Without tables.

[Two questions may be omitted.]

What is the circular measure of an arc? What is the unit of circular measure? What is the length of the unit in degrees, minutes, and seconds. Define the secant of an angle, and what values of x make each of the expressions $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, $\sec^{-1}x$, possible? Write the sec, cosec, and cot of $\left\{ \frac{n\pi}{2} \pm y \right\}$ making n successively 2, 5,

Write a general expression (1) for all the angles which have the same sine as angle a , (2) for all angles which have the same cosine, (3) for all angles which have the same tangent.

2. Make a table showing the sine, cosine, tangent, and versine of the angles 15° , $22\frac{1}{2}^\circ$, 30° , 45° , 60° , $67\frac{1}{2}^\circ$, 75° , 90° , and of the supplements of these angles. The method of obtaining the functions of 15° and $22\frac{1}{2}^\circ$ must be shown. Square roots to be indicated only.

3. Assuming the formulas for the sine and cosine of $(x \pm y)$, deduce the formulas $\sin x \pm \sin y = \dots$, $\cos x \pm \cos y = \dots$, and formulas for the sine, cosine, and tangent of $2x$ and $\frac{1}{2}x$. Simplify the expression $\tan\left(\frac{\pi}{4} + \frac{y}{2}\right) + \tan\left(\frac{\pi}{4} - \frac{y}{2}\right)$.

Write $\sin 5\phi$ in terms of $\sin \phi$.

4. Write the formulas for the solution of a plane right triangle (C the right angle) (1) when c and A are given, (2) when b and c are given, (3) when a and b are given. Solve a right triangle, the hypotenuse being c and the angle $A = \tan^{-1}x$. Find the sine of the angle between two faces of a regular tetrahedron. Solve the equation $3\theta + \tan 2\theta + \tan \theta = 0$.

5. Prove that in a plane triangle $\frac{a+b}{a-b} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$, and $a^2 = b^2 + c^2 - 2bc \cos A$. Deduce the formulas for $\sin^2 \frac{1}{2}A$, and for K . Deduce formulas for the solution of a plane triangle by means of a perpendicular, (1) when two sides and an angle opposite one of them are given, (2) when the three sides are given.

6. State the fundamental theorems of Spherical Trigonometry; deduce directly from these theorems the formulas for the solution of the right spherical triangle, given two sides and an angle, or two angles and a side, or three sides, or three angles. State Napier's rules in full. Apply the following formulas to the polar triangle: $\cos \frac{1}{2}b = \frac{\cos(S-C) \cos(S-A)}{\sin C \sin A}$, and $\sin S = \frac{\sin \frac{1}{2}a \sin \frac{1}{2}b \cos C + \cos \frac{1}{2}a \cos \frac{1}{2}b \sin C}{\cos \frac{1}{2}c}$.

7. Deduce the first and second of Napier's Analogies. Given A , B , L , $\tan^{-1} \frac{2 + \sqrt{3}}{2} N$; find the time of sunset.

8. Solve the equations, $\cos^2 \theta \sin 3\theta + \sin^2 \theta \cos 3\theta = \frac{1}{2}$, and $\tan^{-1}(x-1) + \tan^{-1}(x+1) = \tan^{-1} 3x$. Eliminate ϕ between the two equations, $y = x \tan \phi + a$ and $y = x \tan\left(\frac{\pi}{2} + \phi\right) + a \cot\left(\frac{\pi}{2} + \phi\right)$.

9. Find the relation between the sides a , b , and c of a plane triangle when the angle A is double the angle B . Show that this is impossible unless $\frac{b}{a}$ is greater than, or less than 1.

10. Find the relation between the sines of the sides of a spherical triangle when the angles A , B , and C are proportional to the numbers 1, 2, and 3.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—Time allowed, five hours.

Practical work.

[One question may be omitted.]

1. Take from the tables the following logarithms, prefixing to each the sign of the function: Cosine $96^\circ 30' 35''$, tangent $251^\circ 20' 30''$, secant $239^\circ 38' 45''$, cosecant $351^\circ 29' 29''$, secant $189^\circ 10' 10''$, cotan $0^\circ 30' 30''$. Find the angles corresponding to the following tabular logarithms in the quadrant indicated: Cotan 9.14473 (3d), 8.05462 (3d), tan 9.25442 (3d), and secant 10.74568 (4th). Find the circular measure of $\cotan^{-1} \frac{3}{2} \sqrt{11}$.

2. In a plane triangle, given A , $51^\circ 30' 40''$; a , 38.532; b , 42.175; solve the triangle and find the area.

3. In a plane triangle, given a , 61.267; b , 38.809; and c , 57.912, find the angles and the radii of the inscribed and circumscribed circles.

In a spherical right triangle, given $A, 69^\circ 30' 45''$; $b, 119^\circ 30' 40''$; solve the triangle. In a quadrantal triangle, given $c, 90^\circ$; $a, 75^\circ 20' 20''$; $b, 131^\circ 13' 20''$; solve the triangle.

Given $t, 40^\circ 41' 58''$; $L, 22^\circ 30' 40''$ N ; $d, 21^\circ 40' 40''$ S ; find h and Z , and with the latitude and declination find the time of sunset.

Given $A, 140^\circ 15' 30''$; $B, 132^\circ 16' 30''$; $a, 127^\circ 30' 30''$; solve the triangle.

Given $a, 118^\circ 23'$; $b, 40^\circ 6' 30''$; $B, 29^\circ 41' 30''$; solve by means of Napier's Anal.

Find the value of the expression—

$$\frac{m(m+n)\sin\beta}{\sqrt{m^2\sin^2\beta+n^2\sin^2a-2mn\sin a\sin\beta\cos(a+\beta)}}$$

$m, 310.45$; $n, 200.48$; $a, 38^\circ 30' 30''$; $\beta, 22^\circ 30' 30''$.

Three stations, of which the first is m yards from the second, and the second n yards from the third, and which lie in the same straight line, are viewed from a fourth point; the distance between the first and second stations subtends an angle a , and the distance between the second and third subtends an angle β . Find the distance from the first station to the fourth, when m, n, a , and β have the same values as given in question 8.

ANALYTICAL GEOMETRY.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, three hours.

[One question may be omitted.]

Write the equations to the following lines, (a) through (2, 6) and (3, 2), (b) through (3, 4) perpendicular to $3y-4x=5$. Find the length of the perpendicular from (3, 4) to $5y-12x+8=0$, and find the tangent of the angle between $2y-3x+5=0$, and $-4x+6=0$.

Deduce the rectangular equation to the circle; find the equation to a circle which passes through (8, 6), (1, 5), and (9, -1). Find the equations to tangents to $y^2-10x-4y+4=0$ which pass through (12, 3).

Deduce the equation to the parabola. Find the length of a perpendicular from focus upon a tangent, (1) in terms of x , (2) in terms of m . Prove that tangents at extremities of a focal chord are perpendicular to each other and meet on the directrix. Find the equation to the locus of the middle points of focal chords.

Deduce the polar equation to the ellipse by moving the origin to the left-hand focus and then transforming to polar co-ordinates. Find the length of a focal chord. Obtain the eccentric angle (figure), and find the co-ordinates of a point on the ellipse in terms of it. Prove that the eccentric angles of the vertices of conjugate diameters differ by 90° . The major axis of an ellipse is $2a$ and the foci are midway between the vertices and centre; find the equation to the ellipse and its eccentricity.

Deduce the equation to an hyperbola referred to its asymptotes, and prove that two portions of any secant included between the curve and asymptotes are equal. Construct the loci of the two equations $y^2+8xy+16x^2-8y-33x+16=0$ and $-5xy+2x^2-4y-4x+2=0$.

Trace the loci of the following equations:

$$\begin{aligned} a(y^2-x^2)(y-2x)-y^4 &= 0, & (y-x)(y-4x)(y+2x) &= a^3, \\ (y-x)(y-4x)(y+2x) &= 8ax^2, \text{ and} \\ (x^2+y^2)^3 &= c^2x^2(x+y)^2. \end{aligned}$$

DIFFERENTIAL AND INTEGRAL CALCULUS.

ELECTIVE COURSE.

JUNE, 1879.—Two papers, two hours each.

Cadet-Midshipmen J. L. Schock, J. H. Linnard, J. L. Rees, F. C. Rider, J. J. W. J. A. Hoogewerff, Eugene Carroll, Tasuker Serata, H. K. White, and F. E. Sattos.
Cadet-Engineers J. M. Whitham, and Gustave Kammerling,

I.

1. Evaluate the following expressions:

$$\left[\frac{e^x - e^{-x} - 2x}{x - \sin x} \right]_0^1, \quad \left[\frac{\log x}{x} \right]_x^{\infty}, \quad \left[\frac{\log \sin 2x}{\log \sin x} \right]_0^{\frac{\pi}{2}}, \quad \left[x \tan x - \frac{\pi}{2} \sec x \right]_{\frac{\pi}{2}}^{\pi}.$$

2. Given the fixed line

$$\frac{x}{a} + \frac{y}{b} = 1$$

(axes rectangular), through the origin draw a line OS , cutting the given line at R . Let R be the foot of the ordinate to the point S , through R draw a perpendicular to OS . It is required to find the envelope of this perpendicular, and to make a sketch of the curve.

3. The equation to a curve is

$$r = \frac{a \cos 3\theta}{\sin 4\theta};$$

find p , and make a sketch showing the asymptotes in position.

4. Trace the curve $x^5 - ax^4 - a^2xy + ay^4 = 0$, and find the tangents to the curve at the points where it crosses the axis of X . Trace the curve $ax^2 - x^2y - a^2y = 0$, and find the points of inflexion.

5. Trace the curve
- $y(y-x)^2(y+2x) - 4a^2x^2 = 0$
- .

II.

Integrate the following expressions:—

$$1. \quad \int \frac{dx}{\sqrt{x}}, \quad \int_0^{\pi} \frac{\sin \theta d\theta}{\cos^2 \theta}, \quad \int \frac{dx}{a + bx^2}.$$

$$2. \quad \int \frac{dx}{x^2 - a^2}, \quad \int \frac{ex dx}{1 + e^{2x}}, \quad \int \frac{dx}{x^2 \sqrt{1 + x^2}}.$$

$$3. \quad \int e^{ax} x dx, \quad \int \frac{(2x+3) dx}{x^3 + x^2 - 2x}, \quad \int \sin^3 \theta \cos^2 \theta d\theta.$$

4. Find the whole area enclosed by the curve
- $a^2y^2 - 2ax^2 + x^4 = 0$
- .

If a plane be passed through the middle point of a radius to a sphere and perpendicular to the radius, find the volume of the solid cut off.

5. If the curve $y^2(x-4a) = ax(x-3a)$ revolve about the axis of X , find the surface generated from $x=0$ to $x=3a$.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELEMENTARY PHYSICS.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, three hours.*

1. Describe the method of measuring the velocity of sound in gases.
2. The coefficient of expansion of brass is .000019; of steel is .000011. A brass bar measures 820 mm. on a steel metre scale, both bar and scale at 10° C. What will it measure when both are at 50° C?
3. What are the laws of single refraction? Define the index of refraction and the critical angle, and express their relation.
4. A spherical mirror has a radius of curvature of 60 cm. An object 10 cm. high is placed 80 cm. from its surface. Give position and size of image.
5. What is a prism? Why does it disperse white light? What are the properties of the different parts of the solar spectrum? Why cannot good photographs of the leaves of plants be obtained?
6. The index of refraction of water is 1.336; of glass, 1.54. A glass prism whose refracting angle is 60° is immersed in water. What is the deviation of a ray of light that on striking the prism makes an angle of 20° with the normal?
7. Define the optical centre of a lens. Show how the images are formed in the simple microscope, compound microscope, and celestial telescope.
8. The refracting angle of a prism is 64° . What is the angle of incidence of a ray that makes the critical angle with the normal to the opposite side? $n = 1.54$.
9. Given a gold-leaf electroscope and an insulated box positively charged, how can you give the electroscope a permanent negative charge? Describe the action of the electrophorus.
10. Indicate by arrows the direction of the current in the diagram. Will the end *a* of the astatic needle move above or below the paper?

CHEMISTRY.

ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, five hours.*

1. What are the relative advantages of Chili and India saltpeter for use in gunpowder? How may they be distinguished from each other? What are the sources of these salts, and what is the theory of their formation?
2. Give the members of the chlorine group and show the relation between them.
3. Define an acid; a base; a salt.
4. Given ZnCl_2 , HCl , H_2O , FeO , FeS , NH_4Cl , show the quantivalence of each element. Define quantivalence.
5. The valencies of K, Ba, Bi, and Si being respectively one, two, three, and four, write the hydrates of these elements.
6. Describe hydrogen. Give the method for its preparation used in the laboratory. What reasons have we for believing that its molecule contains at least two atoms?
7. Write the typical formulæ for calcic sulphate, plumbic nitrate, sodic chloride and ammonia.
8. When copper is acted upon by sulphuric acid, we obtain cupric sulphate, water, and sulphurous anhydride. Write the reaction.
9. From cm^3 of P (sp. gr. 1.8) what volume of gaseous hydrogen phosphide will be obtained at 15° C. and 74 cm. pressure? What are the properties of the hydride?
10. Write the chemical names for Ag_2S , $\text{Pb}(\text{NO}_3)_2$, H_2SO_6 , H_2SO_3 , Na_2SO_3 , $\text{Ba}(\text{ClO}_3)_2$.

11. Calculate the percentage composition of potassic chlorate.
12. Describe sulphurous anhydride and explain its use as a bleaching agent.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

CONSTITUTION OF THE UNITED STATES.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, four hours.*

1. Define writ of mandamus, ex post facto law, bill of attainder, concurrent and exclusive jurisdiction, letter of marque, writ of habeas corpus, common law, writ of error.
2. Explain the formation of the State of West Virginia, quoting the constitutional clause applicable to the subject. Explain the position of Missouri during the civil war. Describe the restoration of Tennessee to the Union.
3. With whom rests the power to impeach? to try impeachments? to suspend public officers in recess? to expel members of Congress? to remove disabilities from persons formerly in rebellion? to suspend the writ of habeas corpus? to originate revenue bills? to call for the yeas and nays? to regulate the time, place, and manner of holding elections of Senators? to make treaties?
4. Describe the principal form in which Congress has exercised the power to borrow money. What is the meaning of the phrase "legal tender"? What change was made in the legal tender in 1853? in 1862? in 1877? "The present government paper circulating as money is a government loan—a forced loan." Explain.
5. State the provisions of the Constitution in regard to the power of Congress to lay taxes in general; to lay direct taxes; to lay duties on exports. What is provided as to duties levied by the States? Explain fully all the kinds of taxes referred to in these clauses.
6. Show why a State legislature cannot revoke its own grants. How are city charters regarded in this connection? What was the Dartmouth College case, and what bearing does it have on the subject?
7. Describe the organization of the four classes of United States courts. Enumerate the classes of cases in which the Supreme Court has (1) original jurisdiction, (2) appellate jurisdiction.
8. Explain fully the composition of each branch of Congress, the qualification, mode of election, and term of office of its members, its numbers, and its exclusive powers.

RHETORIC.

MONTHLY EXAMINATION.

MARCH 19, 1879.—*Time allowed, two hours.*

[Starred (*) questions are alternatives.]

1. Explain the importance of conjunctions in the structure of the paragraph. Explain the two principal classes of conjunctions. Explain cumulative, adversative and illative conjunctions, giving examples of each.
- 1.* Show when conjunctions may be omitted between consecutive sentences without any loss of explicit reference, and show in what other ways than by conjunction the reference may be expressed.

State the conditions that should be fulfilled in using figures (1) to aid the understanding, (2) to heighten the feelings. Distinguish between novelty, originality, and y.

"The more general a notion is, the more difficult it is to conceive." Explain, and show what bearing this has upon attainment of simplicity in style.

Give the various meanings of the rhetorical term "taste". Show that taste is, to extent, a matter of personal peculiarity.

Show that originality is a condition of strength; and explain why compositions times have the power to please after frequent repetition.

(For Cadet-Midshipmen). Write an official report, to the Commandant of Cadets, examination of Annapolis Harbor, stating landmarks, depth of water, anchor-channels, security in bad weather and against an enemy.

(For Cadet-Engineers.) Write an official report, to the Commandant of Cadets, on engines and machinery in the steam building.

Official report will count double.]

NAVAL HISTORY.

MONTHLY EXAMINATION.

APRIL 23, 1879.—*Time allowed, two hours.*

What is a carronade? Describe the Greek trireme, and its use. What was the s of Duilius?

Explain the terms flush-deck, quarter-deck, line-of-battle, close-hauled line ahead, of the line, frigate, sloop-of-war.

Explain "breaking the line"; point out its advantages, and tell when and by a it was first adopted in modern warfare. Explain the object of the manœuver acticed in Greek tactics.

Give a brief account of the life and character of the earl of St. Vincent.

Watt, Fulton, Ericsson,—improvements or applications of the steam-engine.

Describe the three principal offensive and defensive weapons of naval warfare, the relative range and power of the former.

Give a short and distinct account of the battle of Aboukir, with details as to ships.

NAVAL HISTORY.

ANNUAL EXAMINATION.

MAY 31, 1879.—*Time allowed, four hours.*

Show how the introduction of (1) guns, (2) sails, (3) steam-engines, (4) armor, in s of war, changed the methods of naval warfare.

Give an account of the relative force of the English and American navies, and glish and American ships in the war of 1812, showing in what way and to what at these circumstances influenced the results.

Give a brief account of *Collingwood*, *Paul Jones*, *Dale*, *Lawrence*. Take two.

Describe briefly the battle of Trafalgar.

The affair of the Chesapeake and Leopard.

Give an account of Perry's victory on Lake Erie, with a statement of the forces gged and attendant circumstances, and draw a diagram of the engagement.

Describe Preble's force before Tripoli, the force opposed to him, the character of arbor and its defenses, and, in general, Preble's method of attack.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

JUNE, 1879.

JOSEPH BERTHA ET LE CONSEIL DE RÉVISION.

Le vieux gendarme Kelz, avec son grand chapeau à cornes, se promenait de large, devant la salle du conseil; dès qu'il me vit, il s'arrêta comme émerveillé, s'écria :

A la bonne heure! à la bonne heure! au moins en voilà un qui n'est pas fâché partir: l'amour de la gloire éclate dans ses yeux.

Et me posant la main sur l'épaule :

— C'est bien, Joseph, fit-il, je te prédis qu'à la fin de la campagne, tu seras ca

— Mais je suis boiteux! m'écriai-je, indigné.

— Boiteux! dit Kelz en clignant de l'œil et souriant, boiteux! C'est égal, av

mine pareille on fait toujours son chemin.

Il avait à peine fini son discours, que la salle du conseil de révision s'ouvrit, l'autre gendarme, Werner, se penchant à la porte, cria d'une voix rude : Joseph tha! J'entrai, boitant le plus que je pouvais, et Werner referma la porte.

En me voyant, M. le sous-préfet dit : Voilà un garçon plein de santé.

Ces mots me mirent en colère; malgré cela, je répondis honnêtement :

— Mais je suis boiteux, monsieur le sous-préfet.

Les chirurgiens me regardèrent, et celui de l'hôpital, à qui M. le commanda

place avait sans doute parlé de moi, dit :

— La jambe gauche est un peu courte.—Bah! fit l'autre, elle est solide.—P

posant la main sur la poitrine : La conformation est bonne, dit-il; toussiez. Je

sai le moins fort que je pus; mais il trouva tout de même que j'avais un bon

— Regardez ces couleurs, dit-il, voilà ce qui s'appelle un beau sang.

Alors moi, voyant qu'on allait me prendre, si je ne disais rien, je répondis : J

du vinaigre.

— Ah! fit-il, ça prouve que vous avez un bon estomac, puisque vous aime

vinaigre.

— Mais je suis boiteux! m'écriai-je tout désolé.

— Bah! ne vous chagrinez pas, reprit cet homme; votre jambe est solide, j'en répu

— Tout cela, dit alors M. le maire, n'empêche pas ce jeune homme de boiter dep

sa naissance : c'est un fait connu de tout Phalsbourg.

— Sans doute, fit aussitôt le médecin de l'hôpital, la jambe gauche est trop com

c'est un cas d'exemption.

— Oui, reprit M. le maire, je suis sûr que ce garçon-là ne pourrait pas supporter

longue marche; il resterait en route à la deuxième étape.

La premier médecin ne disait plus rien. Je me croyais déjà sauvé de la gue

quand M. le sous-préfet me demanda :

— Vous êtes bien Joseph Bertha?—Oui, M. le sous-préfet, répondis-je.

— Eh bien, messieurs, dit-il en sortant une lettre de son porte-feuille, éc

Il se mit à lire cette lettre, dans laquelle on racontait que, six mois avant, j'avais

d'aller à Saverne et d'en revenir plus vite que Pinacle; que nous avions fait ce che

ensemble en moins de trois heures, et que j'avais gagné.

C'était malheureusement vrai! ce queux de Pinacle m'appelaient toujours boitem

dans ma colère j'avais parié contre lui. Tout le monde le savait, je ne pouvais donc

soutenir le contraire.

Comme je restais confondu, le premier chirurgien me dit :

— Voilà qui tranche la question; rhabillez-vous.

Et, se tournant vers le secrétaire, il s'écria :

— Bon pour le service

ORAL EXAMINATION.

Grammatical questions.
 Reading.
 Conversation.

La Fontaine's fables.

- . La Cigale et la Fourmi.
- . Le Corbeau et le Renard.
- . La Grenouille qui veut se faire aussi grosse que le Bœuf.
- . La Génisse, la Chèvre, et la Brebis en société avec le Lion.
- . Le Loup et l'Agneau.
- . Le Renard et la Cigogne.
- . Le Chêne et le Roseau.

Grammar.

Irregular verbs: Faire, lire, mettre, mouvoir, naître, plaire, plaindre, prendre, rire, vivre, aller, envoyer, acquérir, bouillir, courir, cueillir, fuir, mourir, &c., &c..

- . Name the relative pronouns.
- . State the use of the relative pronouns *qui* and *que*.
- . When are *lequel*, *laquelle*, used instead of *qui* and *que*?
- . Define the word "*dont*"; give its meaning and its use.
- . Explain the use of "*ce*" in this sentence: *Il est venu me voir ce qui m'a étonné.*
- . Give the definition of "*on*"; also its meaning and its use.
- . Give the agreement of the past participle in the passive verbs.
- . Is the passive form as much used in French as it is in English?
- . Translate: *We have not been heard. He is called Henry.*
- . Pronominal verbs are subdivided into reflective, reciprocal, accidental, and essential. Define each of these classes.
- . Translate: *Flour sells at ten dollars a barrel. The sun rises, sets.* Give the remarks and rules suggested by these examples.
- . 1. Give the meaning of *Venir pour*, *Venir de*, *Venir à*.
- . 2. Give the use of *Jouer de* and *Jouer à*.
- . 3. Give the rules about the position of the objective pronouns with a verb in the imperative.
- . 4. Give the use of the conditional mode with examples.
- . 5. Translate: *Could you do that? I might try.* Give the remark suggested by these examples.
- . 6. Translate: *You ought to do that.* Give the remark suggested by this example.
- . 7. Translate: *He could have done it. He ought to have done it.* Give the remarks referring to these examples.
- . 8. Translate: *How high is that steeple? That steeple is two hundred feet high.* Give remarks referring to these examples.
- . 9. Translate: *A room fifteen feet long by twelve wide.* Give remarks referring to this example.
- . 10. Translate: *You are two inches taller than I. I have a dollar too much.* Give remarks referring to these examples.
- . 1. Translate: *A dining-room. A steam-engine.* Give the rule.
- . 2. Use "*La plupart*" and "*Bien*" in translating *most men*, *many people*. Give remarks.
- . 3. Give the use, 1st, of the past definite; 2d, of the past anterior.
- . 4. Give the use of the subjunctive.
- . 5. Translate: *The best scholar I ever had.* Give the rule.
- . 6. Give the conjunctions which govern the subjunctive.
- . 7. What is to be remarked about the conjunction *que*?
- . 8. Give the use of the tenses of the subjunctive mode.

SECOND CLASS.**DEPARTMENT OF SEAMANSHIP.****SEAMANSHIP.****ANNUAL EXAMINATION.**

JUNE, 1879.—Time allowed, four hours.

1. Describe the different kinds of rope in use in service, and give some of the uses of each. How is wire rope preserved from weather, &c.? Hemp rope? Name the different parts of a block. Explain and give the power gained in each of the following tackles, viz, single whip, whip and runner, luff, gun tackle, and Spanish burton.

2. Draw and describe a foremast; fore-topmast; topgallant and royal masts; bowsprit and jib-boom. State how they are secured, showing how and where each stay, shroud, &c., is set up.

3. Get shears on board over the side and in place, and step mizzen-mast.

4. Topmast being alongside, get it on board; point it and get cross-trees in place.

5. Describe and draw mainsail; main-topsail; jib and spanker; giving all the fittings, including running rigging, and give the usual lead of the latter.

6. Secure yards and hoist out steam-launch.

7. Rig capstan (patent); bring to on chain; reeve cat and fish; explain bitts, capstans, and stoppers.

8. Explain how topgallant-masts are sent aloft and topgallant-yards crossed, giving the orders.

9. Make up a topsail and course for bending, and bend them, giving the orders.

10. Tack ship under all plain sail, fine working breeze.

NAVAL TACTICS.**ANNUAL EXAMINATION.**

JUNE, 1879.—Time allowed, three hours.

1. Name the formations for a fleet? What constitutes an order of battle?

2. Draw diagram of fleet in natural order (line), and indicate the positions of commander-in-chief, division and squadron commanders, and give distances between vessels at open order, half distance, and close order.

3. What should the strength of the reserve division be relatively to the whole fleet? Of what vessels should it be composed, and upon signal being made for it to reinforce the fleet, what is done?

4. Fleet being in column of vessels heading north in natural order, form it into columns of vessels abreast by divisions on any course.

5. Fleet being in columns of vessels abreast by divisions in natural order heading north, change direction to the left on any course from north to west (2 methods).

6. Fleet in line, form it into double echelons from the center of divisions, preserving original direction.

7. Change from columns of vessels abreast by divisions under sail to single columns of vessels on the other tack, with the lee division leading.

8. Fleet being in columns of vessels abreast by divisions by the wind, wind back; aft; restore the order on the same tack.

DEPARTMENT OF ORDNANCE AND GUNNERY.

GUNNERY.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, four hours.*

Describe steel 3-inch B. L. R., giving details of bore and screw box, with draw-
No description of plug required.

Give a description of a spherical shell from the time it leaves the hands of the
sector till it is ready to put in the gun. Drawings of all parts required. Omit

Describe *in and out gear* and *compressor gear* of XV-inch Monitor carriage, with
wings.

Draw and explain in full detail the Navy time-fuze.

Draw and describe a shrapnel for 3-inch B. L. R. Omit fuze.

Draw and describe in full detail the breech-plug and plug-bracket for 80-pdr.
R.

Divide a gun's crew of 16 men and P. B. for casting loose both sides; give titles
arms.

Describe the construction and internal arrangements of a magazine and light-

Give classification and proportions of ingredients of Navy powders. What are
charges and kinds of powder used in the XV-inch M. L. S. B. and 8-inch M. L. R. ?

A company in column of fours on the march; form to the right into line, on the
into line, and right front into line.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ASTRONOMY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, four hours.*

Describe briefly how the error of a mean-time chronometer may be found, using a
sit instrument and an astronomical clock. Define axis of collimation, axis of rota-
and line of sight. What three things are necessary in order that the transit
ment may be in adjustment? What is amplitude? What is azimuth?

The altitude of a star is measured with a sextant and artificial horizon; the read-
of the sextant is $83^{\circ} 42'$; the true altitude (neglecting parallax and refraction) is
 $15'$: what is the index correction? The least count of a vernier is $6''$, and the
ees on the arc are divided into twelve equal parts: what number of parts of the
ier and the arc are equal to each other? What is a vertical circle? What is the
e vertical?

January 10, 1879 (civil day), longitude $81^{\circ} 15' 30''$ west, the local sidereal time
 $20^h 0^m 0^s$: what is the local mean time? What is the declination of the sun?

What is geocentric, and what heliocentric, parallax? What is the difference
een horizontal and annual parallax? What is refraction? For a given altitude,
t does its amount depend upon? and how is it affected by fluctuation of the bar-
eter and thermometer? Define dip; how is it affected by refraction? Give the

signs of application of dip, parallax, and refraction to an observed altitude. What is a circle of declination? What is right ascension?

5. Explain the methods of the text of finding the latitude at sea. How is the latitude found by a Greenwich chronometer? by correct lunar distances?

6. March 22, 1879 (astronomical day), longitude $171^{\circ} 43' 45''$ west, the altitude of her meridian passage was 47° : what were the two possible values of the latitude? The corrected establishment being $4^h 13^m$, what was the time of the next high water and at which place was it the higher tide of the given day?

7. What causes the change of seasons? and of what is this cause the result? What does the ellipticity of the earth's orbit have very little to do with the change of the seasons? What are celestial latitude and longitude?

8. What is the equation of time? Of what two parts is it composed? What part is used in our calendar, and why? Why do we not use sidereal time in ordinary life instead of mean time? What is a circle of perpetual apparition? What is the upper branch of a meridian?

9. Mention all bodies which have geocentric parallax. What is twilight? How long would twilight last in 60° north latitude, when the sun is on the equinoctial? Define briefly precession and aberration. What is the difference between a parallel of latitude and a circle of latitude?

10. May 6, 1879 (civil day), longitude $151^{\circ} 43' 0''$ east, the corrected distance of the δ from the $\star$ *Regulus* was 80° : what were their respective hour-angles, and what was the declination of the δ ?

11. What is the difference between a lunar cycle and a cycle of eclipses? What is the harvest moon? Which kind of eclipse occurs the more frequently, and why? Which occurs more frequently at a given place? What is diurnal libration? What is the ecliptic? the equinoctial? the solstitial colure?

12. What is the cause of the tides? of the daily inequality? What is the corrected establishment of a port? What is flood, and what neap, tide? What is the primary of the tide? How do you know if a certain tide of a given day will be the highest? What is anomaly? a line of apsides?

13. When does the retrograde motion of planets occur? Mention the planets in that order from the sun and in the order of their magnitudes, giving the number of satellites of each. What is departure? hour-angle? the zodiac?

14. October 15, 1879 (astronomical day), the hour-angle of the true sun was $+2^h 23^m$, the longitude being $68^{\circ} 43' 30''$ east: what is the local sidereal time? and also the horizontal parallax of the moon at the same instant? How long will it be before the moon's meridian passage?

15. What is a comet? a shooting star? a detonating meteor? an aerolite? How are stars catalogued? What is a binary star? What is the distinction between a zodiac and a nebula? What is proper motion? What is the difference between astronomical and civil time? What is the Gregorian calendar?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, four hours.

1. Define the specific inductive capacity of a dielectric. How is the speed of a signal through a cable influenced by the inductive capacity of the insulating material?

2. At the Naval Academy, in a locality removed from masses of iron, where the latitude is $70^{\circ} 57'$, a magnet made 6.31 vibrations per minute in a horizontal plane; on board the monitor, just abaft the turret, the same magnet made 4.72 vibrations per minute.

dip being $65^{\circ} 15'$. Compare the horizontal and total intensities of the earth's magnetic force at the two places.

What is the definition of unit current in the electro-magnetic system? What are units of current resistance and E. M. F. adopted in practice?

Describe the commutator of the Farmer's machine. A Farmer's machine is used with sufficient velocity to produce an E. M. F. of 15 volts; resistance of machine, 10 ohms. The poles are connected by circuits in multiple arc. The first contains two series of .45 ohms resistance each, with leading wires of .8 ohms resistance. How many fuzes may be introduced into the other circuit with leading wires of 1.5 ohms resistance, and all fuzes be fired in both circuits, if it require .75 webers current to fire a fuze?

What causes polarization of a battery, and what reagents are used to prevent it in the Daniell's, Grove's, and LeClanche cells? Describe a Grove's cell and the chemical reactions that take place in it when it is in action.

It is wished to explode a submarine mine in which are two fuzes in continuous circuit, each fuze having a resistance of one ohm at the firing point, the resistance of leading wires being 18 ohms, and the strength of the current necessary to fire a fuze being .8 webers. What is the least number of cells of E. M. F. .98 volts and R 4 ohms each that may be employed, and how must they be arranged?

If at Dublin, where, in 1875, the absolute intensity of the earth's magnetic force was 10.42 British units, a wire one metre long, perpendicular to the line of dip, was moved in a direction perpendicular to the line of dip and to itself with a velocity of 100 metres per second, what was the value in C. G. S. units of the E. M. F. developed in the wire?

If a current from 12 Grove's cells in series is sent through two voltmeters in series, one containing a solution of cupric sulphate and the other a solution of silver nitrate, how much silver and how much copper will be deposited while 4 grms. of zinc are dissolved in the entire battery? How much deposited if the amount of zinc consumed, the battery being joined in 2 groups of 6 cells each, at wt. of Zn^{64} 65; Cu^{64} 63.4.

How may H (the horizontal intensity) be determined?

A galv. whose resistance was 892 ohms was shunted with a shunt which reduced its sensibility to $\frac{1}{10}$, but, in order to maintain the same strength of C as before in the circuit, an additional resistance was introduced: how much was it?

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

CALCULUS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—Time allowed, five hours.

Deduce the differential of $\frac{1}{x}$ in terms of an unknown constant, and determine the constant.

Given $y = \log(x + \sqrt{x^2 - a^2}) + \sec^{-1} \frac{x}{a}$, find $\frac{dy}{dx}$.

Given $y = \frac{2}{\sin^2 x \cos x} - \frac{3 \cos x}{\sin^2 x} + 3 \log \tan \frac{x}{2}$, find $\frac{dy}{dx}$.

Find the position of a line passing through the point (a, b) when the sum of its intercepts on the co-ordinate axes is a minimum.

Determine the semi-vertical angle of the cone of minimum volume described about a given sphere.

Expand $\frac{e^x}{1+x}$ in powers of x to the term containing x^4 inclusive.

Expand $\log \tan \left(\frac{\pi}{4} + x \right)$ to the term containing x^3 inclusive.

5. Find the value of $\left(2 - \frac{x}{a}\right)^{\tan^{-1} \frac{\pi x}{2a}}$ when $x = a$; also the value of $x^{\frac{1}{\log(e^x + 1)}}$ when $x = 0$.

6. Find the length of a perpendicular from the origin on the tangent to an ellipse in terms of the semi-axes and the angle (β) between the perpendicular and the major axis of x .

6. Find the radius of curvature of the curve $\sqrt{x} + \sqrt{y} = 2\sqrt{a}$.

7. Derive the equations of the cycloid and determine the radius of curvature.

8. Determine the value of $\int \frac{dx}{(1+x^2)\sqrt{1-x^2}}$, and of $\int_0^{\pi} \cos^{2n} \theta d\theta$;

also prove that $\int_0^{\frac{\pi}{2}} \cos^{2n} \theta d\theta = \int_0^{\frac{\pi}{2}} \sin^{2n} \theta d\theta$.

9. Find the length of the curve $r^{\frac{1}{2}} = a^{\frac{1}{2}} \cos \frac{1}{4} \theta$, the limits being 0 and 2π .

9. Find the area inclosed by one loop of the curve $a^2 y^4 = x^4 (a^2 - x^2)$.

10. Prove Simpson's three-eighths rule.

10. Find the volume of a solid cut from a right circular cylinder by a plane passing through the centre of the base and inclined at an angle β to the plane of the base.

11. A solid is bounded by six plane surfaces, of which two are parallel rectangles with the longer side of one parallel to the shorter side of the other; the lengths of their sides are 2 and 5, and 1 and 4, respectively, and the perpendicular distance between them is 144: find the volume of each of the four parts into which the solid is divided by three sections parallel to the rectangular faces, one being the middle section, one the square section, and the third the section containing the main diagonal.

MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, four hours.

1. A frigate's quarter-boat is 32 feet long, and weighs, with oars, etc., 2,880 pounds. The centre of gravity is 17 feet from the bow. The falls are hooked 3 feet from the stem and 1 foot from the stern, and are rove through double upper and lower blocks. The davits are formed of a straight piece of length $4\left(2\sqrt{3} - \frac{3}{2}\right)$ feet, and a quadrant

of a circle of radius 6 feet, and are stepped in a shoe or saucer with the straight part vertical and passing through a socket, 5 feet above the saucer. The falls lead from the upper block at an angle of 60° with the vertical, and the forward fall belays to a hook on the davit, while the after fall belays inboard. Neglecting the weight of the falls, and davits, find, in the case of the forward fall—

P, the vertical pressure on the shoe,

Q, the horizontal strain on the shoe,

R, the horizontal strain on the socket,

S, the tension on hauling part of falls,

T the whole tension on the hook of upper block,

θ , the angle made by T with the vertical.

2. Find P, Q, R, S, T, and θ for the after fall and davit of the above-mentioned boat.

3. Find the centre of gravity of the solid formed by the revolution of the sector of a circle about one of its bounding radii, a denoting the radius of the circle, and θ the angle of the sector.

Or—

3. A frustum is cut from a right cone by a plane bisecting the axis; show that it will rest in equilibrium with its slant height on a horizontal table, if the height of the cone bears to the diameter of its base a greater ratio than $\sqrt{7}$ to $\sqrt{17}$.

a space described by a falling body in the 5th second of its fall was one-sixth described in the last second but four; what was the whole space described? Reduce the equation to the path of a projectile in a non-resisting medium. A shot is projected from the top of a tower whose altitude is h , with a velocity the height nh ; find the maximum range on the horizontal plane through the top of the tower, and the corresponding angle of projection.

Or—

Find the time of a small vibration of a right square pyramid about an axis through its vertex parallel to one of the sides of the base. Compare the times of emptying two equal hemispheres filled with fluid, through apertures, one in the vertex, the other in the base. A diving bell 10 feet in height, in the form of a paraboloid of revolution, is sunk in water until the surface in the bell rises 5 feet, determine the distance of the top of the bell from the surface of the water, the height of the water barometer being 33 feet.

Extra question.

Find the centre of the pressure on the area of an immersed cycloid, the base being the surface of the fluid.

Find the centre of the pressure on the area inclosed by one loop of the lemniscata $\cos 2\theta$, the initial line being vertical, and the pole in the surface of the fluid.

DIFFERENTIAL AND INTEGRAL CALCULUS.

SEMI-ANNUAL EXAMINATION.

ELECTIVE COURSE.

JANUARY, 1879.—Time allowed, five hours.

Midshipmen P. R. Alger, L. S. Norton, J. B. Bernadou, H. G. Dresel, H. Phelps, J. C. Sherman, and G. E. West.

Engineers W. F. Durand, A. W. Stahl, L. D. Miner, W. F. C. Hasson, W. S. and W. H. Alderdice.

Expand in ascending powers of x the functions $\frac{\sin 3x}{\sin x \sin 2x}$ to the term containing $(1+x)^{\frac{1}{2}}$ to the term containing x^3 .

Evaluate the expression $\left[(1+x)^{\frac{1}{2}} \cot^2 x - \frac{\log(1+x)^2}{\tan^2 x} \right]_0^{\frac{\pi}{2}}$.

Prove that the evolute of the epicycloid

$$x = \frac{a}{2} (3 \cos \psi - \cos 3\psi), \quad y = \frac{a}{2} (3 \sin \psi - \sin 3\psi)$$

is a similar epicycloid.

Evaluate $\int_0^1 \frac{\log x \, dx}{1+x}$ and $\int_0^\pi \frac{x \sin x \, dx}{1+\cos^2 x}$.

If $c = \int_a^b \phi(x, c) \, dx$, prove that $\frac{du}{dc} = \int_a^b \frac{d}{dc} \phi(x, c) \, dx$.

Evaluate $\int_0^\pi \frac{x^2 \, dx}{1 + \cos \theta \cos x}$.

Given $\int_0^\infty \frac{x^{2n} \, dx}{1+x^{2n}} = \frac{\pi}{2n} \operatorname{cosec} \frac{2n+1}{2n} \pi$, derive $\int_0^1 \frac{x^n + x^{-n}}{x + x^{-1}} \cdot \frac{dx}{x} = \frac{\pi}{2} \sec \frac{n}{2} \pi$.

Determine the value of $\int_0^1 \frac{(z^n + z^{-n} - 2) \, dz}{(1-z) \log z}$.

6. Determine the value of $\int_0^{\infty} e^{-x^2} dx$, and from the result derive the $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

7. Find the whole area inclosed by the curve $\left(\frac{x}{a}\right)^2 + \left(\frac{y}{a}\right)^2 = 1$.

7. Find by means of gamma-functions the area of one loop of the curve, $r^{\frac{1}{2}} = a^{\frac{1}{2}}$.

8. Find an expression in gamma-functions for the length of one loop of the curve $r^m = a^m \cos m\theta$.

8. Find the length of the curve $x = 6 \sin \psi - 2 \sin^3 \psi$ and $y = 2 \cos^3 \psi$, the limit $\psi = 0$ and $\psi = \pi$.

9. Find the volume common to the sphere $r = \frac{a}{2}$ and the solid formed by the rotation about the initial line, of the curve $r = a(1 + \cos \theta)$.

9. Find the area between the asymptote and the curve in the case of the curve of Descartes. Find also the area inclosed by the loop.

10. Derive the rectangular equation of the loxodromic curve, and determine its length.

ELECTIVE MECHANICS.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, four hours.

Cadet-Midshipmen P. R. Alger, J. B. Bernadou, H. G. Dresel, L. S. Norton, H. A. A. Ackerman, and G. E. West.

Cadet-Engineers W. F. Durand, W. F. C. Hasson, A. W. Stahl, L. D. Minor, S. Sample.

1. A particle is describing a curve; find its accelerations along and perpendicular to the tangent at any instant. Determine also the accelerations along and perpendicular to the radius vector.

2. A boat starting from a given point A on the bank of a river is propelled with constant velocity u and is constantly directed toward a point Q on the opposite bank; the points A and Q being in the same line perpendicular to the direction of the current, and v denoting the velocity of the current, find the equation of the path.

2. A particle projected with a velocity u is acted on by a force which produces a constant acceleration f inclined at a constant angle α to the direction of motion; find the intrinsic equation of the path described.

3. A particle moves in a straight line under the action of an attractive force which varies inversely as four-thirds power of the distance from a fixed point in the line; determine the time of an oscillation when the particle starts at the distance a from the fixed point, with the velocity due to a fall from infinity. Find also the time of the motion when the attraction varies as the first power of the distance.

4. Determine the polar equation of the path described by a particle acted on by a central attraction, and prove that the sectorial area described by the radius vector is proportional to the time.

5. Find the law of the central attraction in order that a particle may describe a lemniscata, the centre being at the node. Determine the equations of the paths described by particles when the central attraction varies inversely as the square of the distance.

6. A projectile moves in a resisting medium; determine the values of x and y when the resistance is proportional to the cube of the velocity. Also determine approximately the equation of the path described when the resistance is proportional to the square of the velocity.

DEPARTMENT OF MODERN LANGUAGES.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, two and a half hours.**Translate into French :*

THE ROYAL OAK.

Charles II, son of the unfortunate Charles I, king of England, whom the English Parliament, under the usurper Cromwell, put to death upon the scaffold, endeavored several times to conquer the throne of his ancestors, but, after losing many battles, his troops were entirely defeated at Worcester. The adventures of the unhappy prince after that battle are curious. After having run the greatest dangers, he found an asylum and friends at the house of four brothers, husbandmen of the name of Netherell. There, the better to disguise him, they stained his hands and cut his hair, gave him the dress of a wood-cutter, and put an axe in his hand. Thus disguised they led him into the woods. During some days the king had for his bedding but some straw under the trees. The soldiers of the Parliament often came to seek for him, and the king, in order to avoid them, was obliged to climb up an oak, whence he saw pass at his feet the people who were seeking him. This oak received at the restoration the name of the Royal Oak, and till about the middle of the eighteenth century one might see at the fruiterers' in London, on the 29th of May, the anniversary of the preservation of the king, gilded oak leaves. Some persons even wore them in their button-holes on that day.

Parse the phrase, "The adventures of the unhappy prince after that battle are curious."

Give in a table (a) the present indicative, 1st person singular and plural; (b) the imperative, 2d person singular; (c) the present subjunctive, 3d person singular and plural; (d) the future, 1st and 2d person singular, of *aller*, *arriver*, *venir*, *pouvoir*. Give the feminine of the adjectives *petit*, *grand*, *jeune*, *ancien*, *gros*, *beau*, *vieux*.

State the rule of the past participle, when conjugated with *avoir*. Give two examples.

Translate into English :

J'ai raconté jusqu'à présent les grandes choses de la guerre, des batailles glorieuses et la France, malgré nos fautes et nos malheurs. Quand on a combattu seul contre les peuples de l'Europe,—toujours un contre deux et quelquefois contre trois,—et on a fini par succomber, non sous le courage des autres, ni sous leur génie, mais sous la trahison et le nombre, on aurait tort de rougir d'une pareille défaite, et les vainqueurs auraient encore plus tort d'en être fiers. Ce n'est pas le nombre qui fait la grandeur d'un peuple ni d'une armée, c'est sa vertu. Je pense cela dans la sincérité de mon âme, et je crois que les hommes de cœur, les hommes sensés de tous les pays le diront comme moi.

Il faut maintenant que je raconte les misères de la retraite, et voilà ce qui me paraît le plus pénible.

On dit que la confiance donne la force, et c'est vrai surtout pour les Français. Tant qu'ils marchent en avant, tant qu'ils espèrent la victoire, ils sont unis comme les doigts de la main, la volonté des chefs est la loi de tous; ils sentent qu'on ne peut réussir que par la discipline. Mais aussitôt qu'ils sont forcés de reculer, chacun n'a plus de confiance qu'en soi-même, et l'on ne connaît plus le commandement. Alors ces hommes lâches,—ces hommes qui s'avançaient gaiement à l'ennemi pour combattre,—s'en vont

les uns à droite, les autres à gauche, tantôt seuls, tantôt en troupeaux. Et ce tremblaient à leur approche s'enhardissent; ils s'avancent d'abord avec crainte, voyant qu'il ne leur arrive rien, ils deviennent insolents, ils fondent sur les troupes à trois ou quatre pour les enlever, comme on voit les corbeaux, en hiver, tomber sur un pauvre cheval abattu, qu'ils n'auraient pas osé regarder d'une demi-lieue lorsqu'il marchait encore.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, two and a half hours.*

Translation from English into French.

MUCIUS SCAEVOLE.

If we may believe the story, when Porsenna, king of Etruria, had besieged Rome to reinstate Tarquin in his rights, Mucius determined to deliver his country from a dangerous enemy. He disguised himself in the habit of a Tuscan, and, as he spoke their language fluently, he gained an easy introduction into the camp, and into the royal tent. Porsenna sat alone with his secretary when Mucius came. The Roman immediately rushed upon the secretary and stabbed him to the heart, mistaking him for his royal master. Mucius, unable to escape, was seized. He gave no answers to the inquiries of the courtiers, and only told them that he was a Roman, and, to give them a proof of his fortitude, he laid his right hand on an altar of Vulcan, sternly looking at the king, and without uttering a groan, boldly told him that three hundred young Romans like himself had conspired against his life, and were determined either to destroy him or to perish in the attempt. This extraordinary conduct astonished Porsenna, who made peace with the Romans and retired from Rome. Mucius obtained the surname of Scaevola, the left-handed, because he lost the skin of his right hand by burning it in the presence of the Etrurian king.

Traduisez le morceau suivant en Anglais.

LA MÈRE DE WASHINGTON.

A l'époque où Washington fut nommé commandant en chef des armées américaines, et peu de temps avant qu'il allât rejoindre les troupes à Cambridge, la mère de Washington quitta sa maison de campagne pour s'établir au village de Frédéricksburg, situés loin du théâtre de la guerre; elle y resta durant presque toute la lutte révolutionnaire placée sur la ligne des postes: tantôt c'était un courrier qui passait, apportant la nouvelle d'une victoire, et tantôt c'était un messager de malheur, annonçant les détails d'une défaite: mais la fortune favorable ou contraire ne put altérer le calme de la mère de Washington. Mettant toute sa confiance en Dieu, elle montra à ses concitoyens que leurs efforts battaient pour les droits de l'homme, pour la liberté et pour le bonheur des siècles.

A la nouvelle de ce glorieux passage de la Delaware qui vint relever les troupes battues des Américains, plusieurs des amis de Mrs. Washington se réunirent pour la féliciter. Elle les reçut avec dignité, disant que l'événement était heureux: que George paraissait avoir bien mérité de la patrie; et, comme les parents cessaient de louer la conduite du général: Mes bons messieurs, répondit-elle, cessez de louer la conduite du général: Mes bons messieurs, répondit-elle, cessez de la flatterie . . . mais mon George n'oubliera jamais les leçons que je lui ai données; il ne s'oubliera pas lui-même en dépit de tant d'éloges.

Lorsque Mrs. Washington fut informée de la prise de Cornwallis, elle s'écria: Dieu soit loué, la guerre est terminée; la paix, l'indépendance et le bonheur vont habiter notre patrie!

FIRST CLASS.**DEPARTMENT OF SEAMANSHIP.****PRACTICAL SEAMANSHIP.****ANNUAL EXAMINATION.**

JUNE, 1879.—*Time allowed, three hours.*

Describe the watch, quarter, and station bills of a sloop of war, and state the instruction given by them. Name the different station bills.

Make preparations for sea in all respects, and station officers and men for getting underway under sail.

Riding to a coast current by starboard anchor, wind four points on starboard bow, close aboard on port-beam, weigh and stand out, using no spring.

Wear ship short round.

Weather main topsail sheet and clewline carried away; what to do?

Ship under all plain sail and starboard stunsails, struck by a squall; what to do?

Supposing yourself in a cyclone, south latitude, ship hove to, wind S. E., then S.; would you proceed? What are the indications of a cyclone?

Where does a surf break heaviest on a flat beach, and where is the greatest danger? a boat through such a surf.

What are the boat salutes (under oars, sails, and laden) for all officers?

Two sailing vessels crossing, wind N. E., one heading E. S. E., the other N. W.; which has the right of way? Two steamers crossing, which has the right of way?

the different fog signals and rules regarding lights.

SHIP BUILDING.**SEMI-ANNUAL EXAMINATION.**

JANUARY, 1879.—*Time allowed, four hours.*

WOODEN SHIP BUILDING.

How do you locate and prepare a building-ship? Describe all the preparations to be made before laying the keel of a ship. What rates of inclination must be used to? how regulate the blocks, &c.? Describe a keel. What is it made of? made? how fastened to stem and stern posts? What is a *room and space batten* its use?

What are the frames of a ship? how divided? what timbers are they composed

How are the timbers put together? Describe method of raising and regulating them. How and when is a ship regulated? What are the filling timbers, their use, advantages, if any? What is the *cutting-down* or *throating line*?

Make sketch of transverse section at $\oplus$. Describe manner of diagonal bracing. How are the sides of a ship united forward, aft, and amidships? Give detail of the joinings. Define bilge strakes, thick strakes, and shear strakes. Name the different keelsons.

What preparations are necessary before commencing to plank a ship? Give method of planking. Define garboard strake, and state how it is fastened. What are ribbands, sheers, and sirmarks?

Upon what does the transverse strength of a ship depend? Give plan of decking of a ship, showing all the timbers, &c. Define spirketing.

6. How many different kind of rudders are there? Describe each kind, how and arrangement connecting them to ships. How are boats distinguished in the manner of building? Describe each kind.

7. How many kind of docks are there? Name them; give a general description of each, and method of docking a vessel in each. Describe a marine railway.

8. Detail preparation necessary for launching a ship. How do you determine the breadth of the ways? What distance between ways? What are poppets? What ship stops on the ways when partly launched, what is to be done?

IRON SHIP BUILDING.

Time allowed, four hours.

1. Name the different forms of keels in common use, and describe keel of an iron-clad ship. Describe the stem of an iron-clad, the manner of scarfing and uniting pieces, joining to the keel, &c. Describe stern posts of iron-clad, with and without lifting propellers.

2. How many parts in a frame of an iron ship built on the transverse system? Name the parts and state how they are fitted together. How are the keelsons fitted? When are double-reverse angle-irons fitted?

3. Define the longitudinal system, and state what advantages it has over the transverse system. Give longitudinal system of Mr. Scott Russell.

4. Describe the bracket system, and state what are its advantages, if any. Explain the manner of dividing the double bottom into water-tight cells. What is the arm of a bracket and how formed? Give one of the modes of building bracket framing.

5. What are the principal varieties of beams in use at the present time? Give sketches showing how they are constructed. Give rules for sizes of beams. How are beams spaced in war vessels? Describe beam arms most used, and manner of fitting beams.

6. Describe the different systems of plating, and make a sketch of the one in common use, showing the arrangement of butts, rivets, &c. Give illustration of steam plating. Explain manner of using it. How are sizes of rivets regulated, and give rules for spacing them.

7. How are water-tight bulkheads fitted? Illustrate manner of securing them to the ship's side. What bulkheads are there on board ship that, besides being essential for storage, are considered structurally? What are the plates, and how can they be used to do the most service?

8. What are sheathed ships? State the object of this system of construction. Describe the different methods and illustrate the best. What are composite ships? Give general features of the system, and state what class of vessels are built on this plan.

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE AND ARMOR.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—Time allowed, five hours.

1. State the differing conditions in which iron exists in cast iron, wrought iron, and steel; also in general terms the nature of the processes by which it is made to pass from one to the other, and reciprocally.

2. Name the properties which distinguish iron in each of these three conditions, and contrast them with one another with reference to suitability for making gun

Discuss the difficulties in the way of making heavy homogeneous guns of, 1st, cast 2d, wrought iron; 3d, steel; and, granting such a homogeneous gun to exist, the why its full strength cannot be developed to resist the force of the discharge. State and discuss the general principles upon which built-up guns are made; also nature of the strains to be resisted, and the practical effect of this last consideration upon the construction of the gun.

Define bronze. State the difficulties in the way of producing a perfect mixture of ingredients, and how the results of this difficulty are seen in the cast gun. How is the Gatling gun made?

Describe the manufacture of the Parrott gun, and the system of Palliser's construction.

What is the object of hollow-casting guns? Having your stock of pig iron, name the different processes in the making of a hollow-cast XV-inch gun, stating the nature of each step, but avoiding details of the operation.

Describe in full detail the French system of breech-loading.

Describe the Siemens-Martens process of producing steel.

Describe the effect of rapid and slow cooling upon cast iron and steel; and the practical use made of these qualities in the case of steel.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, five hours.*

State the general properties, mode of preparation and uses of gun-cotton.

Describe the Schénkle and German percussion fuses (drawings).

Describe the effect of varying the size of grains and density upon the action of gunpowder.

What is the object of rifling? Advantages of elongated over spherical projectiles?

Describe the systems of rifling in use in the U. S. Naval Service, and state the advantages and disadvantages of the systems.

Describe the arrangement for giving compression in the central compressor car (drawings).

Describe the howitzer boat carriage (drawings).

Upon what consideration does the effect produced by a projectile depend? In answering this question, the effects produced by a shell exploding when imbedded in a target need not be discussed nor the character of any target other than may be used by a ship.

Describe the working of the Boulengé chronograph; state the object of the disjunctive. What is meant by the disjunctive-reading, and to what times does that reading correspond?

How is a battalion to be handled when moving up to and attempting to carry by assault an enemy's position?

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, five hours.*

Required, the mean effective pressure in an engine, having given the diameter of the cylinder, 40 ins.; stroke, 4 ft.; clearance, $\frac{1}{2}$ of space displaced by piston; steam cut-off at $\frac{1}{2}$ of stroke from commencement; steam pressure, 55 lbs. per sq. in. per gauge; condenser vacuum, 26 ins., the barometer standing at 30. Required, also, the relative quantity

of fuel expended in this case, to that required when following full stroke with mean pressure found. Temp. and relative volume of the steam when cutting off 140° F. and 381° respectively; and when following full-stroke 270° and 614° respectively. Consider the weight of a cubic foot of fresh water 62.5 lbs.

2. Sketch and describe the single and double poppet valve, and state the advantages of the latter over the former.

3. Given a pair of engines, total area of piston 2,000 sq. inches; stroke 3 ft.; clearance, 5 per ct. of space displaced by piston; steam pressure 40 lbs. per sq. in.; cut-off at $\frac{1}{4}$ of stroke from commencement; revolutions 60 per minute; volume of steam and water at initial pressure 640; temp. 267° F.; coal consumption per hour 1,900 pounds; percentage of loss by blowing off 14.3. Required, the weight of pounds of water evaporated per hour per pound of coal.

4. Temp. of water in boiler 300° F.; temp. of feed-water 50° F.; density of water $\frac{1}{2}$; density maintained in boiler 2. Required, the gain in fuel by utilizing the exhaust steam sufficient to raise the temperature of the feed-water to 140° F.

5. A ship is making 11 knots per hour, the screw propeller making 55 revolutions per minute, and having a pitch of 22 feet. Required, the slip in per cent. of the pitch of the propeller, a knot being taken at 6,082 feet. Define negative slip.

6. Sketch and describe the Bourdon steam-gauge, Laue's improvement, and the "Manometer" steam-gauge.

7. Given 1 lb. of coal containing 92 per ct. carbon, 6 per ct. hydrogen, and 2 per ct. ash; to find the maximum temperature of furnace when burned with 18 and 24 lbs. of air. Sp. heats H_2O , 475; CO, 217; O, 218; N, 245.

8. Given 1 lb. of free hydrogen contained in a quantity of solid fuel, burnt with an excess of 50 per ct. of air above that necessary for perfect combustion; the combustion of 1 lb. of hydrogen liberates 50,000 units of heat. Required, the heat available for the generation of steam, the air entering at 60° F., and the products of combustion escaping at 600° F.

9. Deduce the formula for the distance S traveled by the piston of a steam engine while the crank turns through an angle β ; angularity of connecting-rod not considered.

10. Deduce the formula for the thickness of cylindrical boilers, and solve the following problem: Unbalanced internal pressure 100 lbs. per sq. in.; diameter of boiler 36 in.; value of metal in boiler-plate 56,000; joints double riveted; factor of safety required, the thickness of metal.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

NAVIGATION.

SEMI-ANNUAL EXAMINATIONS.

JANUARY, 1879.—Time allowed, five hours.

1. Describe the methods of performing the various operations incident to a voyage at sea, from taking the data from the log to finding the course and distance made good and the current.

2. Deduce (by Napier's rules) formulas for finding the distance and course between two points by great-circle sailing; also the formulas for finding the latitude and longitude of the vertex.

3. How is a great-circle route laid down upon a chart? (no formulas required) What advantages does a knowledge of this route give?

4. Deduce the formulas for the dip of the horizon (with and without refraction). Radius of reflected ray = 7 R.

5. How is the horizontal parallax of the moon obtained? How is the parallax

ade obtained? How will you find the apparent semi-diameter of a heavenly body seen from the surface of the earth?

Give one method complete, (with the reasons therefor) for the conversion of local time.

Deduce (by Napier's rules) the formulæ for finding h and z of a heavenly body at a place and time.

Discuss 7 when $d=0$; when $t=6$ hours.

Deduce the formula for the hour angle of a heavenly body when on or nearest to prime vertical. Under what circumstances would it be desirable to know this angle? Deduce the formula for the hour angle of a heavenly body when in the sun. How will you ascertain the time of actual sunset (disappearance of sun's limb below the horizon)?

Deduce (by Napier's rules) the formulæ for finding the latitude by an altitude at time. When will this method be useful at sea?

What are ϕ , ϕ' , and ϕ'' respectively? How is each marked, and why?

Deduce the formula for finding the latitude by an altitude very near noon. Is the t of this formula obtained? How is the formula used practically?

Deduce the equation of equal altitudes. State what quantities are involved in equation for ΔT_0 , and how they are obtained.

Apply 13 to finding the chronometer correction, giving each step in detail with reasons therefor.

In the direct method of lunar distances draw the figure, name the various parts of the triangles considered, and state why the projections of D and D' intersect. Of what advantage are lunars, and for what purpose are they chiefly used?

Define circles of equal altitude. (Give a diagram.) How may the position of centre of these circles be plotted upon the chart? What is a line of position?

How will you find the latitude and longitude of a vessel by Sumner's method, vessel not being stationary?

What determines the angle between the lines of position? What would be the favorable conditions that could be selected for determining the position of a ship at sea?

How are chronometers wound and compared? What is the object of this comparison? What is meant by second differences in this connection? What do you consider to be the best method for obtaining the error and rate of a chronometer with small appliances furnished to sea-going vessels? Give your reasons for the selection of this method.

By observation at 9.45 a.m. the longitude at noon was $79^{\circ} 21'$ east; by observation at 3.45 p.m. the longitude at noon was $78^{\circ} 54'$ east; what longitude will you deduce to be the true longitude at meridian?

Extra questions.

Credit will be given for these unless all the regular questions are attempted.

Deduce the formulæ for the meridional parts of the spheroid, given—

$$r = \frac{a \cos L}{(1 - e^2 \sin^2 \sqrt{L})^{\frac{1}{2}}} \text{ and } R = \frac{a(1 - e^2)}{(1 - e^2 \sin^2 \sqrt{L})^{\frac{3}{2}}}.$$

Deduce the formulæ for finding the longitude by Littrow's method.

Deduce the formulæ for finding the longitude by equal altitudes at sea. State how observations are taken, and how the operations are performed.

Deduce the formulæ for finding the latitude by two altitudes of the same body, declination remaining unchanged and the Greenwich time being approximately known.

Deduce Bradley's formula for finding the refraction of a star.

ANNUAL EXAMINATION.

JUNE, 1878.—*Time allowed, four hours.*

1. Define variation and deviation. When are they named easterly and westerly? Having a deviation table and the variation from the chart, how will the course to be steered by compass to make a given true course? Variation easterly; $\odot$'s true bearing, S. 70° W.; observed bearing, S. 40° W.; what is the Variation, 27° westerly; deviation, 16° easterly; true course, NE.; what compass course?

2. What are the different methods of ascertaining on each of the 32 points of the compass? Give the details of each. State which you would prefer in practice, and give the reasons for this preference.

3. How is a Napier's curve constructed and how is it used? How is a compass course compensated? Using the *Warrior's* deviation table, solve the following: True course, N.; variation, 16° easterly; what is the compass course? True course, SE.; variation, 21° westerly; what is the compass course? Compass course, S. $\frac{1}{2}$ E.; variation, 16° westerly; what is the true course?

4. What are the causes of the deviation of the compass in an iron vessel? Given the deviation on the eight principal points, how will you construct a deviation table by the method of coefficients? What causes the heeling error in a vessel? How may it be corrected? Will this correction be permanent, and why? On which courses will the heeling error be the greatest, and why?

5. In the general equation

$$\delta = A + B \sin \zeta + C \cos \zeta + D \sin 2\zeta + E \cos 2\zeta,$$

what are A, B, C, D, and E, respectively? Which are the changing and which are permanent coefficients, and why are they so? How may you ascertain when the deviation is changing? Using same deviation table as in 3, solve the following: heeling coefficient being $1\frac{1}{2}^{\circ}$, how must a ship head to make NE. true when the compass course is S. 40° E., the variation being 20° westerly?

6. Having just received a theodolite (previous history unknown), how will you proceed to examine its adjustments?

7. Describe the various methods of running in a shore line or wharf. In the work of a survey, how is the base-line laid down? How are the positions of stations determined? Give the details of the work.

8. How are lines of soundings run? How are the positions of soundings plotted on the chart? To what plane are all soundings reduced? How is this done? What is a bench-mark, and its use?

9. Describe briefly the method of making a running survey. (Give a sketch of the method.) What is the final base-line? How is the work plotted when the positions by triangulation and astronomical observations do not agree?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT AND LIGHT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, five hours.*

1. What reason is there to believe that a well-constructed air thermometer is more accurate than a mercurial one?

2. The coefficient of linear dilation of platinum for 1° C. is .0000058; of brass it is .000019. The standard temperature for platinum scale is 0° C.; for brass scale is 62° F. A meter equals 39.37079 inches. What will be the length of the yard on the platinum scale when both are at 24° C.?

Give the physical explanation of a freezing mixture. What is the ordinary action of an ice machine?

Describe in detail Pictet's method of liquefying the so-called permanent gases.

A Dumas' flask contains, at 20° C. and 750 mm. pressure, 500 cm.³ of dry air and has with its contents 10 grms. Filled with a vapor at 40° and 740 mm. it weighs grms. The coefficient of cubical expansion of glass is .00003. Required, the density of this vapor.

Define conductivity. Deduce Forbes' expression for the conductivity of metallic and describe Forbes' method.

To what classes of errors is one liable in physical research? How may they be avoided? Describe the method of graphical representation of the results of experiment. What are formulas of interpolation?

What is meant by the *quality* of heat rays? What is light equilibrium of surfaces? A balloon whose capacity is 120 cubic meters is filled with hydrogen; weight of men and basket, 50 kilos.; Barom. 755 mm.; temp. 18° C.; dew-point, 7° ; max. pressure of aq. vapor at 7° , 7.5 mm. Weight of liter of hydrogen at 0° and 760 mm. grms. What is the strain on a rope that binds the balloon to the ground?

Describe the cycle of operations of the theoretical engine of infinitesimal range. Reverse the cycle. Give the area that is the mechanical equivalent of *Mde*.

Deduce Canot's Function and the scale of absolute temp. Prove that there can be no lower temp. than the zero of this scale.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

INTERNATIONAL LAW.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, five hours.*

When does the state acquire title to a prize taken at sea? When may the title be transferred to individuals? What is the effect of this fact in the case of subsequent recapture of the prize? What is the general rule as to the place, and national authority of prize court?

What is the rule of international law, and what is the practice, with regard to persons and private property of enemies found in the country on the breaking out of a war? in regard to private debts? to public debts?

I. Name the ship's papers required by both municipal and international law, and those required by international law alone. What is a register? a charter party? a bill of lading?

II. State the principal arguments for and against the destruction of private property at sea, as distinguished from private property on land.

Explain the terms extraterritoriality, doctrine of continuous voyages, rule of *uti possidetis*, right of postliminy, municipal law, civil law, domicile.

III. What is the effect of war on intercourse between the subjects of belligerents? on partnerships entered into before the war? How is the question of partnerships affected by the fact that one partner is neutral? How may these rules be modified by licenses of trade?

IV. When does a blockade cease? What is the penalty for a breach of blockade, as to ship and cargo, and how long should the liability continue? At the beginning of a blockade, how are neutral vessels loading in enemies' ports affected?

V. How far is the carrying of persons or papers forbidden to a neutral in time of war? What is the penalty for carrying contraband? What circumstances may be considered in determining the contraband character of articles of doubtful quality? Give the result of the Civil war in United States. Efficient blockade of Southern ports.

(a) In command of the United States steamship Supply, you search the schooner Stephen Hart, off the coast of Florida, and find that she is laden with and munitions of war. Her master states that her destination is Cardenas; she has no manifest or invoice. What will you do and what will be the result?

(b) Later, you search English schooner Argonaut, off Hatteras Inlet, bound from Nova Scotia to Key West, but attempting to enter the inlet. The master claims he is short of water, and has no oil for his lamps. Discuss.

X. (a) War breaks out between the United States and Great Britain. In command of the United States steamship Peacock, cruising in the northeast trades, you see a North German vessel from Bremerhaven for St. Thomas, with an assorted cargo. You find sundry cases of merchandise, belonging to English firms, transhipped there at agents in Bremen. What will you do? Justify your action.

(b) Later, you meet a French bark from Havre for Valparaiso, with a cargo of material consigned to the Chilean Government. What will you do?

DEPARTMENT OF MODERN LANGUAGES.

ANNUAL EXAMINATION.

Time allowed, two hours and a half.

Translate into Spanish:

MADRID ET SES ENVIRONS.

Madrid est situé sur quelques collines basses, dont le sable est grossier et terreux. Les rues de Madrid sont aussi bien et mieux coupées que celles d'aucune autre ville d'Europe. On compte à Madrid neuf ou dix mille maisons, dont une quantité de grandes et spacieuses. Ces maisons sont en granit, en briques, en bois et en cailloux. En général, les façades de ces maisons sont peintes. Si l'on veut connaître les productions rares qui existent à Madrid dans les trois arts libéraux, on peut consulter la description savante de cette ville qu'a faite don Antonio Ponz à l'appréciation de qui j'en suis rapporté dans différentes occasions.

Les vents du nord règnent à Madrid pendant l'hiver, et ils y sont très-froids, secs et très-pénétrants. Ceux de l'ouest et ceux du sud, au contraire, y sont chauds et pluvieux. Madrid est presque situé au centre de l'Espagne; il est très-élevé relativement à la mer, car on descend continuellement depuis Madrid jusqu'à la Méditerranée et les eaux des ruisseaux et des rivières de ses environs vont se joindre au Tage, et se perdre ensuite dans l'Océan. Les montagnes de Guadarrama, avec leurs cimes, sont les seules qu'on voie de Madrid. Le sommet en est couvert de neige pendant plusieurs mois de l'année. Les grandes rues de Madrid sont pavées en silex taillés; les autres le sont en cailloux arrondis qu'on trouve dans les environs. Il y a à Madrid beaucoup de fontaines publiques, dont l'eau est très-bonne, et divers marchés.

Translate into French:

Los Egipcios son los primeros que han conocido las reglas del gobierno. Aquella nacion grave y seria, pronto conoció la verdadera mira de la politica, que consistia en hacer la vida suave y los pueblos felices. La temperatura de su patria siempre favorable forme producia caracteres firmes y constantes. Como la virtud es el cimiento de las asociaciones, la cultivaron con esmero. La gloria que les han dado de ser los mas reconocidos de todos los hombres, muestra que eran tambien los mas sociables, pues las buenas obras son el vínculo de la concordia pública é individual. Sus leyes eran simples, justas, y propias para unir los ciudadanos entre sí. El que pudiendo salvarse un hombre acometido, no lo hacia, era castigado con la muerte tan rigorosamente.

el asesino. Así los ciudadanos estaban bajo la protección unos de otros, y todo el pueblo del estado estaba unido contra los malos. Entre los Egipcios no era tampoco útil ser inútil al Estado.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THEORETICAL NAVAL ARCHITECTURE (ELECTIVE).

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, three hours.

Cadet-Midshipmen A. B. Clements, J. Hood, R. H. Miner, E. E. Hayden, H. S. Chase, J. Moore, H. Wike.

Cadet-Engineers R. Gatewood, F. T. Bowles, C. B. Lubbe, W. M. McFarland, B. C. Bryan, Carr, A. M. Hunt, E. O'C. Acker, H. K. Ivers, R. T. Isbester.

Derive by the method of finite differences the formula

$$u_x = u_0 + x\Delta u_0 + \frac{x(x-1)}{1.2} \Delta^2 u_0 + \frac{x(x-1)(x-2)}{1.2.3} \Delta^3 u_0 + \dots$$

thence derive Simpson's one-third rule.

Derive Weddle's rule for quadratures, and Woolley's rule for volumes.

* Find the height of the metacentre above the centre of buoyancy in the case of a ship constructed on the wave-line principle, with no middle body; the length of entrance being l , and that of the run h , c denoting the depth and b the greatest breadth, the mid-ship section being a semi-ellipse.

† Determine the metacentre of a ship whose water-lines are trochoids aft and solids forward, and whose mid-ship section is a semi-ellipse, l and l' being constants; determine also the centre of gravity of the after-body.

Find the angle of maximum effect of a ship's rudder; (α), when the available power for turning the rudder is unlimited; (β), when the power is limited.

Derive the formula for determining the height of the metacentre of any ship above the centre of buoyancy. Derive the formula for computing the augmented area, and show how this formula may be employed in determining the probable draft of a ship.

Explain the theory of the wave-line system of construction, and deduce the relations to the water-lines of the fore-bodies and of the after-bodies. Also mention and describe some other curves that are used for the water-lines of ships.

* For Cadet-Engineers.

† For Cadet-Midshipmen.

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, five hours.

1. Required, the number of degrees of superheating in steam which at a pressure of 85 lbs. per sq. in. per gauge has a temperature of 370° F.; $A = 8.2591$; $\frac{H}{2C} = 0.00001184$.

$$\frac{B^2}{4C^2} = 0.00001184.$$

2. Required, the efficiency of the heating surface of a boiler, provided that the heat of conduction varies as the square of the difference of the temperatures. The boiler has 600 sq. ft. of heating surface, and burns 300 lbs. of coal per hour with a supply of 100 lbs. of air per pound of fuel, which is composed of $C = 0.87$; $H = 0.05$; $O = 0.08$. The mean specific heat of products of combustion = 0.238. Temperature of steam in the boiler 315° F., and of the air 50° F.; $a = 180$.

3. Required, the number of lbs. of coal per hour per square foot of grate surface to be burned by natural draught in a boiler with 100 sq. ft. of grate surface and a chimney 50 feet high; length of flues = 10 ft.; $f = 0.012$; $G = 6$; area of tubes = 10 sq. ft.; diameter of tubes 4"; temperature of air 50° ; volume of air swept per hour at $32^{\circ} = 300$ cubic feet.

4. Deduce the expression for the dynamic value of the heat which must be communicated to one pound of the fluid in order to produce simultaneously the indefinitely small variation of temperature dt , and the indefinitely small variation of volume dv . Analyze this expression.

5. Sketch a hot-air engine where the temperature changes at constant pressure, and also its diagram of energy, and show from this diagram why the energy per cubic foot swept by the working-piston is less than in a steam-engine working with the same pressure and expansion. Compute the energy exerted and the heat expended (in ft. lbs.) per cubic ft. swept by working-piston of the above engine, working between the temperatures 138° and 438.8° F.; volume of 1 pound of air at lower temperature = 15 cubic ft. Ratio of expansion = 2; $\phi = \frac{p_0}{\tau_0} \left(\frac{\log_e \tau}{\gamma - 1} + \log_e \tau \right) + C$; $\phi = 53.15$; $\log_e n = \log n \times 2.3026$.

6. Required (by the approximate formulas), the energy exerted per cubic foot swept by piston, the efficiency of the steam and the number of pounds of coal per hour per horse power in an engine using saturated steam in a jacketed cylinder ($p = 75$ lbs. per sq. in. per gauge). Ratio of expansion 5; volume of steam at initial pressure = 4.816 cubic ft. Back pressure = 4 lbs. per sq. in. Available heat per lb. of coal = 6500000 ft. lbs.

7. Determine the speed of piston of an engine from the following data: Back pressure at centre of pressure of screw-blades = $80.27 \frac{1}{2}$ lbs. Circumference of cylinder = 27 ft.; stroke of piston = 3 ft.; area of piston 2000 sq. in.; back pressure = 4 lbs. per sq. in. Coal consumed per minute = $34 \frac{1}{2}$ lbs.; available heat per

al = 5400000 ft. lbs.; ratio of expansion = 3; $p_h = \frac{15\frac{1}{2}p}{r}$ per cubic ft. swept by

On; $f = \frac{1}{2}$; $R_o = 1$ lb. per sq. in.; $\frac{p}{p_m} = 1.56$.

Sketch, and explain the principles of a binary vapor engine.

DESIGNING MACHINERY.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, five hours.

Give two methods of estimating from the drawings the H. P. necessary to drive a designed vessel at a given speed.

Determine the diameters of the cylinders of a compound engine to develop 3,000 H. P.; stroke of piston 4'; revolutions per minute 55; clearance in large cylinder $\frac{1}{4}$ cent. of stroke displacement; pressure per sq. in. per gauge in boilers 76 lbs.; ratio of expansion 6; back pressure per sq. in. 4 lbs.; exhaust-valve closes $15''$ end of stroke of piston; $p \propto v^{-1}$, $\log_e n = \log n \times 2.3026$.

Calculate the diameter of the neck of a connecting-rod $7' 6''$ long for a condensing engine of 50 inches diameter of cylinder, using steam of 40 lbs. per sq. in. gauge pressure; modulus of crushing 36,000; factor of safety 8. What should be the thickness of cylinder?

Design a wrought-iron crank-shaft for a pair of condensing screw engines $50''$ diameter of cylinder and $42''$ stroke, connected at right angles, using steam of 40 lbs. pressure; factor of safety 8; modulus of wrenching 50,000; of cross-breaking 100,000; $n = \frac{1}{2}$; shaft to be calculated for torsion only, and cranks to be $10''$ thick.

Solve by the Zeuner diagram this and the following question: Scale of crank to be $1.5'' = 1'$; all valve-circles where dimensions are known to be full size; rarity of rods to be neglected. Design a simple slide-valve from the following:—Diameter of cylinder $50''$; stroke of piston $42''$; revolutions per minute 65.47; steam-port to open when the piston is $\frac{1}{4}''$ from beginning of stroke, and to be closed when the piston is $4\frac{1}{4}''$ from end of stroke; valve to have $\frac{1}{4}''$ exhaust lead. Find, first, the length of the steam-port (the length being $50''$); second, the steam-lap; third, steam-lap; fourth, the exhaust-lap; fifth, the travel of the valve; sixth, the position of the valve when the exhaust-valve opens, also when it closes; seventh, the angular advance to the nearest minute. Give results in inches.

Design a Meyer expansion-valve in conformity with the following conditions:—Diameter of piston $42''$; travel of the main valve $6''$; steam-lap $1\frac{5}{16}''$; steam lead $\frac{5}{16}''$; of expansion-valve $6\frac{1}{4}''$; angular advance (δ_o) of the expansion-valve 90° , the valve to cut off between the limits of $\frac{1}{2}$ the stroke and that due to the lap of the main valve; when working at the lowest rate of expansion, the blocks to be close together. Find, first, the least length (l) of the expansion blocks; second, the greatest distance ($ex.$) that the main and cut-off valve centres will be apart; third, the least length of the main valve between the outer edges of the ports; fourth, the distance the blocks are apart when cutting off at half stroke. Give results in inches.

Design cylindrical iron boilers for engines of question 2; diameter of boiler $10'$; ends to be double-riveted; factor of safety 8; strength of metal 54000 lbs. per sq. in.; temperature of feed 110° ; of steam 321° ; engines using 20 lbs. of steam per H. P. Give the number of boilers and dimensions of furnaces, thickness of boiler plates, coal consumed per hour, area of grate surface, heating surface, and calorimeter tubes.

Sketch and discuss the several methods of strengthening cylindrical furnaces and, being flat surfaces in steam boilers.

Required, the dip of a pair of feathering-paddles, each 6 feet long, to drive a screw of 6031 square feet of augmented surface at 15 knots per hour; slip allowed, 5 per cent. of speed of vessel; coefficient of friction .0033.

10. What amount of condensing surface should the engines of questions 2 and 7 have? Calculate the diameter of a double-acting circulating-pump for these engines; temperature of injection 70° ; discharge 85° ; and exhaust 212° ; efficiency of the pump .75.

SECOND CLASS.

DESIGNING MACHINERY.

ANNUAL EXAMINATION.

JUNE, 1879.—*Time allowed, five hours.*

1. What is the angle made by the crank with the line of centres at the instant when the crosshead and crank-pin have equal linear velocities? Length of connecting-rod = 6 feet, crank = 1.5 feet.

2. Prove that two equal circles, set equally eccentric and at a distance between axes equal to their diameter, will not roll together.

3. Will a wheel of six teeth drive a wheel of five pins?

4. Show the method of generating the teeth of wheels whose faces and flanks are different curves, so that any two wheels of the same pitch will work together.

5. Given two axes, A and B, meeting at an angle of 60° , to connect them by gear-wheels so that $\frac{\text{angular velocity of } A}{\text{angular velocity of } B} = \frac{4}{3}$. Also show the method of laying out the teeth.

6. What distance has the crosshead traveled when the crank whose length is 18 inches makes an angle of 80° with the line of centres; length of connecting-rod 6 feet?

7. Find the trains for a 32-day clock, the barrel to carry 16 coils of the cord; the pinions to have at least 8 and the wheels not over 120 teeth; the swing-wheel to have 40 teeth, and the pendulum to make 80 vibrations per minute. Clock to have hour, minute, and second hands.

8. Sketch Sir William Armstrong's hydraulic crane, making the velocity-ratio of power to weight 1.6.

9. Sketch and explain Ferguson's mechanical paradox. Also deduce the value and sign of E for each of the three trains.

10. Find the diameters of a set of pulleys that shall give four different speeds having a common ratio, the first and last speed ratios being $\frac{1}{4}$ and $\frac{1}{3}$, the sum of the diameters of the corresponding pulleys being 30 inches.

11. A horizontal drum has $2\frac{1}{2}$ coils of rope about it, with both ends hanging down; on one end is a weight of 10 pounds: required, the weight that this will support at the other end.

12. Sketch a differential pulley. What is the least diameter that can be given to the small wheel of the double block in order that the tackle may remain in equilibrium when the diameter of the pivot is $\frac{1}{4}$ inch, and the diameter of the large wheel 6 inches; $f=0.2$. Also what is the velocity-ratio of power to weight lifted under these circumstances.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

STRENGTH OF MATERIALS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1879.—*Time allowed, four hours.*

1. Prove that the moment of inertia of a surface relatively to an axis not traversing its centre of gravity is greater than the moment of inertia round a parallel axis traversing

ing its centre of gravity, by the product of the area of the surface into the square of the distance between those axes. Find the moment of inertia of a right triangle (sides h and b) about an axis passing through its centre of gravity perpendicular to its plane.

2. A pair of principal stresses of any intensities and of the same or of opposite kinds being given, it is required to find the direction and intensity of the stress on a plane in any position at right angles to the plane parallel to which the two principal stresses act.

3. Show that, if a solid body be wholly immersed in a fluid, the resultant of the pressure of the fluid on the solid body is a vertical force equal and directly opposed to the weight of the portion of the fluid which the solid body displaces.

3. A homogeneous solid consisting of a hemisphere and a cylinder having a common base floats in water with the cylinder uppermost, and with its axis vertical; find the greatest height of the cylinder consistent with stability of the equilibrium when the spherical surface is partly immersed.

4. Find the stresses on the horizontal beams and on the diagonal braces of a half-lattice girder uniformly loaded at every joint.

5. Find the proper ratio of the thickness to the radius of a thin hollow cylinder, and also of a thin hollow sphere, each being subjected to a given internal pressure.

6. Derive an expression for the area of the cross-section at any point of a suspension rod of uniform strength.

7. Find the equations connecting the thickness of the plate, the diameter of the rivets, and the distance between the centres of two rivets in the following cases; viz., a plate joint overlapped, single riveted; a plate joint overlapped, double riveted; a plate-butt joint with a pair of covering plates, single riveted; a plate butt joint with a pair of covering plates, double riveted.

8. Deduce the approximate equation $M = EI \frac{d^2y}{dx^2}$ and find the maximum deflection of a beam of uniform cross-section, uniformly loaded, and supported at both ends.

9. Find the dimensions of the rectangular cross-section of a wrought-iron beam 20 feet long, supported at both ends, which shall be deflected but $\frac{1}{1000}$ of its length under a working load of 225 pounds per linear foot, given $E = 27006000$ and the working strength 9000 pounds per square inch.

9. Find the strongest rectangular beam that can be obtained from a given cylindrical log.

10. Find the proper thickness of a propeller-shaft, the maximum moment of the engines being given.

11. Find the form of the surface of the water in a bucket of an overshot wheel.

12. Find the time of a double oscillation of a ship, in terms of its radius of gyration, and the height of its metacentre above the centre of gravity.

THE METHOD OF LEAST SQUARES.

ANNUAL EXAMINATION.

JUNE, 1879.—Time allowed, two hours.

1. Deduce the equation to the probability curve, $y = ce^{-h^2x^2}$.

2. A base-line was measured five times with the following results; viz., 537'.21, 537'.16, 537'.33, 537'.30, 537'.25: find the most probable length of the base-line, and the probable error of this length.

3. The same angle is measured by two observers, A and B , with the following results; viz., A , $67^\circ 18' 50''$, $67^\circ 18' 45''$, $67^\circ 18' 40''$, $67^\circ 18' 55''$, $67^\circ 18' 50''$; B , $67^\circ 18' 00''$, $67^\circ 18' 10''$, $67^\circ 18' 30''$, $67^\circ 18' 50''$, $67^\circ 19' 00''$: find the relative weights of the observers, and the adjusted value of the angle.

4. At a station O were measured the following horizontal angles; viz., $MOA = 46^\circ 53' 29''$, A with a weight 4, $MOB = 83^\circ 14' 33''$, B with a weight 16, $MOC = 135^\circ 27' 11''$, C

with a weight 9, $\angle O C = 88^{\circ} 33' 41''.7$ with a weight 2: find the most probable value of the angle $\angle O B$, and the weight of this result.

5. In the quadrilateral $W X Y Z$, nine angles were measured; viz.,

$$Z W X = W = 106^{\circ} 07' 30'' \quad W X Y = X = 66^{\circ} 34' 09'' \quad W Z Y = Z = 84^{\circ} 00'$$

$$W X Z = X_1 = 36^{\circ} 34' 21'' \quad X Y W = Y_1 = 49^{\circ} 17' 23'' \quad Z W Y = W_1 = 41^{\circ} 24'$$

$$W Z X = Z_2 = 37^{\circ} 18' 12'' \quad Y W X = W_2 = 64^{\circ} 08' 34'' \quad W Y Z = Y_2 = 53^{\circ} 21'$$

Find the adjusted value of the angle W .

6. If the angles of a triangle are, by measurement, α, β, γ , prove that the value of α is $\alpha + \frac{180^{\circ} - \alpha - \beta - \gamma}{3}$.

FINAL EXAMINATION.

JUNE, 1879.

CADET-MIDSHIPMEN.—CLASS OF 1877.

GUNNERY.

1. Describe the 8-inch M. L. R. as converted from the XI-inch M. L. S. B.
2. Describe the breech-loading system in use in the Navy.
3. Describe the monitor carriage, giving drawings of the compression and "out" gear.
4. Name and discuss the two principles upon which built-up guns are constructed, stating the practical difficulties in the way of obtaining the theoretical performance aimed at in either system.
5. What are the advantages of elongated over spherical projectiles? What disadvantages? Define a *system of rifling*. State what systems are in use in service, and what are the advantages and disadvantages of each.
6. What is gunpowder? Give present classification and proportions of the ingredients in service powders. State the use of each ingredient. Discuss the effect of the size of grain and density of powder upon the phenomena of explosion, and the strain upon the gun.
7. Describe the Parrott and Butler projectiles; also the shrapnel for 3-inch guns.
8. Describe the Schenk percussion fuze and fuze (Boxer) for projectiles of 3-inch B. L. R.
9. A vessel of war carries the following battery: 2 8-inch M. L. R., 1 11-inch IX-inch M. L. S. B., broadside on the waist; 1 60-pounder B. L. R., forecable port; 1 3-inch B. L. R.; 1 Gatling. And officers: 1 commander, 1 lieutenant-commander, 1 ensign, 5 midshipmen, 1 lieutenant of marines, and usual staff officers; 100 men, including marines. Arrange the crew in divisions, assigning officers to stations at quarters, and giving the number of men for each division.
10. Organize a landing party from same ship—boats, steam launch, pailing boats, cutters, gig, whale boat, and dingy.

NAVAL TACTICS.

1. Give the different divisions and subdivisions of a fleet of twenty-four vessels, with the positions of the commander-in-chief and division and squadron commanders.
2. What are the formations for a fleet, and what constitutes an order of battle? When is a fleet in reverse inverted order?
3. What precautions are necessary when a vessel is serving as guide; and what she is disabled, upon which vessel does the duty devolve in the different formations?
4. Fleet being in line heading north, form it into column of divisions from right to left at right angles to the original direction.
5. Fleet being in double column heading north, form it into line to the right at right angles to the original direction.

6. Fleet being in line, form it into echelons of vessels from right of divisions on any course.

7. Fleet (under sail), change from single column of vessels to columns of vessels abreast by divisions on the other tack, with the leading division to windward.

8. Change from line to double echelon inverted from the right and left of fleet on No. 7. When is the position pennant hoisted?

9. In reporting latitude, longitude, and time of day by signal, how is it made?

10. Being on board a dispatch vessel, and about to communicate with a fleet, what signals are made? How do you hoist and when do you change them?

NAVIGATION.

Time allowed, six hours.

I.

- a. Adjust the index glass of a sextant.
- b. Adjust the horizon glass of a sextant.
- c. Adjust the telescope of a sextant.
- d. How will you determine whether the limb is correctly divided or not?
- e. How will you determine whether the limb is equally divided or not?
- f. How is a negative angle read?

II.

- a. Find the course between two points on Mercator's chart.
- b. Find the course between two points by Mercator's sailing (by inspection).
- c. Find the course between two points by middle latitude sailing (by inspection).
- d. The course being found as above, how is the distance found?
- e. How is the course generally found?

III.

- a. Describe the Ritchie azimuth compass and compare it with a dry compass. State wherein it excels.
- b. Having the magnetic and compass bearings of an object, how is the deviation of the compass found?
- c. How is the above principle applied to the construction of a deviation table?
- d. Explain briefly what causes heeling error in a compass.

IV.

- a. What is a traverse table?
- b. Describe the log and mark the line.
- c. Describe Massey's (or the patent) log.
- d. Give the headings of the columns of the log-book.
- e. How do seamen understand the following terms: *leeway, drift, set, slack water*?

V.

Draw an astronomical triangle. State the parts given and required in the following problems: time sight, azimuth, $\phi'' \phi'$ method for latitude, altitude and azimuth.

VI.

- a. Define error and rate of a chronometer.
- b. How would you obtain them in port?
- c. Having three chronometers which do not agree, what longitude would you take if you were running toward a danger?
- d. When would you use lunars?
- e. In making the computations, what logarithmic tables are necessary in the approximate and the direct methods respectively?
- f. State what is meant by the direct method. Mention two of the most common approximate methods.

VII.

- a. What is a line of position?
- b. How is this line found when the observed body is near the meridian?
- c. How is this line found when the observed body is near the prime vertical?
- d. State for what problem, formerly much used, Summer's method is substituted?
- e. What use may be made of a single line of position?

VIII.

- a. How will you select a base-line for a harbor survey?
- b. How are the positions of other points, relative to the base-line, determined?
- c. What instruments are necessary in making the survey?
- d. How are the positions of soundings, relative to shore stations, determined?
- e. State how the base-line is plotted on paper; also, how one station is plotted.
- f. How would you plot the *correct* soundings between the base stations and the just determined?

FIELD WORK.

Time allowed, four hours.

Each Cadet-Midshipman was required to take the following observations:

- a. Altitude of sun for chronometer correction.
- b. Astronomical bearing of an object upon the opposite bank of the Severn Estuary.
- c. Altitude of sun for latitude by $\phi'' \phi'$ method.

In *b* and *c* the chronometer correction as found by *a* was used.

FRENCH.

Translate into French :

At the time of the reform of the Roman calendar by Julius Caesar, the year was considered as consisting of three hundred and sixty-five days and a quarter, reckoned three consecutive years of three hundred and sixty-five days each; the fourth year, bearing the name of bissextile, consisted of three hundred and sixty-six days. However, the length of the year adopted by Julius Caesar was too long by eleven minutes and nine seconds. This error amounted to one day in one hundred and thirty years; so that, in 1582, the spring equinox fell upon the 11th of March, while it was to have fallen on the 21st of that month. Pope Gregory XII wishing to remedy this error, which increased more and more, in compliance with the advice of the most skillful astronomers, ordered the 15th of October to be reckoned when the 11th occurred and to suppress, for the future, three leap years every four hundred years. So the famous Gregorian reform, which does not cause an error of more than one day in four thousand years.

Translate into English :

UN ASPIRANT EN CORVÉE.

Monsieur Tropicain, vous allez embarquer dans le canot et pousser à terre. Veuillez à ce qu'aucun homme n'en sorte pour aller boire au cabaret.

Les avirons plongèrent en même temps et le léger canot vola sur l'eau.

En moins d'une heure de nage, ils étaient de nouveau accostés à leur bord.

Monsieur, tous vos hommes sont-ils là? demanda l'officier de quart.

Non, capitaine, répondit le midship, il y en a deux qui sont restés à terre.

Parfaitement! je me doutais bien que c'était la première fois de votre vie que vous alliez en corvée.

LE JOURNAL DE BORD.

La table de loch.

Enregistrer dans la table de loch toute circonstance digne d'attention.

Un navire dans le nord-ouest.

reçu une goëlette dans le sud.

Sé les couleurs pour un brig-goëlette, courant à l'est.

Alors, le cay Finistère restait au N. 85° E.

Iceberg en vue dans le S. O.

Heures du soir, entendu un coup de canon dans le lointain.

Sé porter pour raisonner avec ce navire que nous supposons en détresse.

O heures, ayant de beaucoup dépassé la distance et n'ayant rien trouvé, nous en

conclu que le navire avait sombré, alors nous avons serré le vent et pris l'ONO.

Evé le feu de l'île Rousse au S. 42° E. du compas-étalon.

Le feu de Dædalus.

La goëlette se tenait au nord, avec tout dehors.

Examinations in Seamanship and Steam Engineering were oral.



INDEX TO EXAMINATION PAPERS.

	Page.
Candidates for admission as Cadet-Engineers	58
Fourth class	69, 70
Geometry, Third class	77
Candidates for admission as Cadet-Midshipmen	54, 55
Candidates for admission as Cadet-Engineers	58
Second class	85
Third class, elective	78
Second class	87
Second class, elective	89
Third class	79
of the United States, Third class	80
First class Cadet-Engineers	103
Second class Cadet-Engineers	104
Second class	86
Physics, Third class	79
Fourth class	73
Gymnasium, Candidates for admission as Cadet-Midshipmen	54, 56
Candidates for admission as Cadet-Engineers	60
Fourth class	71
Class of 1877	108
Fourth class	74
Third class	82
Second class	91, 92
Class of 1877	108
Candidates for admission as Cadet-Midshipmen	55, 56
Candidates for admission as Cadet-Engineers	60
Candidates for admission as Cadet-Engineers	59
Fourth class	70
Second class	85
First class	95
Class of 1877	106
Light, First class	98
Fourth class	72
of the United States, Fourth class	73
Natural Law, First class	99
Engines, First class Cadet-Midshipmen	95
First class Cadet-Engineers	102
Second class	88
Second class, elective	90
Least Squares, Second class Cadet-Engineers	104
Architecture, First class, elective	101
History, Third class	81
Statistics, Second class Cadet-Midshipmen	84
Class of 1877	106
U. S. Army, First class Cadet-Midshipmen	96, 98
Class of 1877	107

Ordnance and Armor, First class Cadet-Midshipmen	
Rhetoric, Third class	
Seamanship, Second class Cadet-Midshipmen	
First class Cadet-Midshipmen	
Ship-building, First class	
Spanish, First class	
Spelling, Candidates for admission as Cadet-Midshipmen	
Candidates for admission as Cadet-Engineers	
Strength of Materials, Second class Cadet-Engineers	
Theory of Equations, Fourth class, elective	
Trigonometry, Third class	



5
3
5
3
ANNUAL REGISTER



OF THE

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

THIRTY-FIRST ACADEMIC YEAR,

1880-81.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1880.



ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

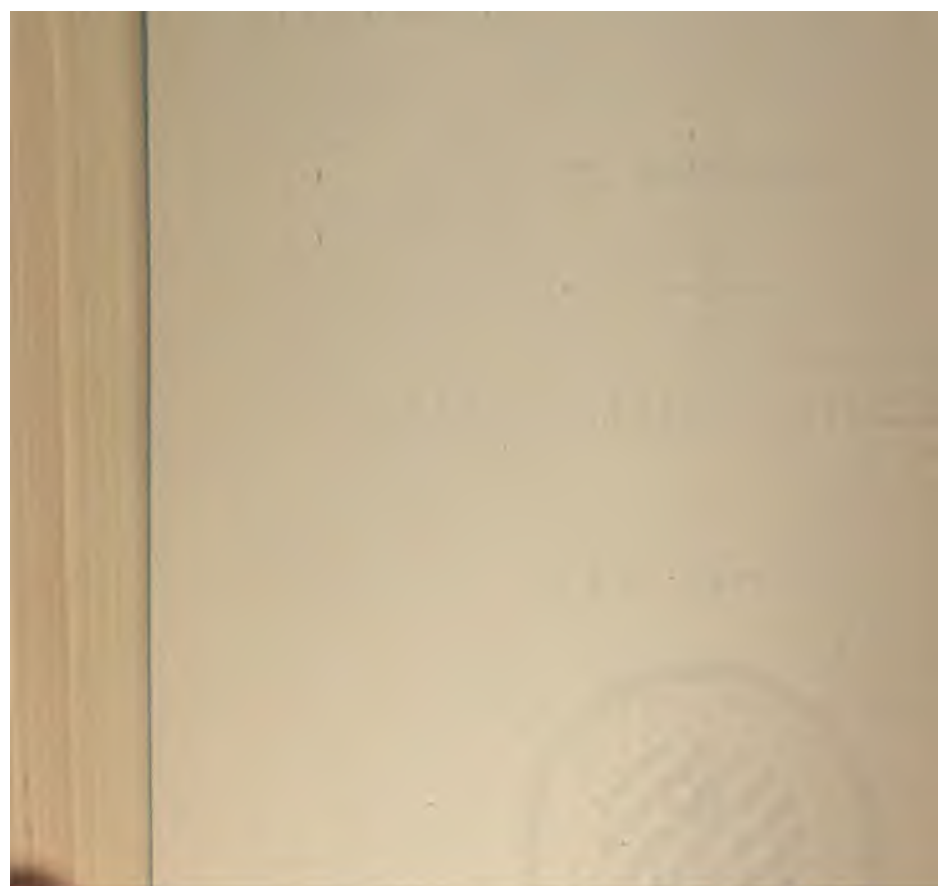
ANNAPOLIS, MD.

THIRTY-FIRST ACADEMIC YEAR,

1880-81.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1880.



CONTENTS.

	Page.
GENERAL SKETCH	4
OF VISITORS	6
CALENDAR	6
YEAR, 1880-81	7
STUDENTS	8
TEACHING BOARD	11
OFFICERS	11
WITH RELATIVE STANDING IN CLASSES	12
GENERAL SUMMARY	35
ADMISSIONS AND DISMISSALS	36
RIFLE-MATCH	37
EXPEDITION-CRUISE, 1880	38
OF COEFFICIENTS	42
RESULTS, 1879-80	43
REQUIREMENTS FOR ADMISSION	59
OF INSTRUCTION	71
NUMBER OF RECITATIONS	76
ADMISSION-PAPERS, 1879-80	80
OF EXAMINATION-PAPERS	125

THE UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by Hon. George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., the land occupied by Fort Severn, which was given up by the War Department for the purpose. The course was fixed at five years, of which the first and last only were spent at the School, the intervening three being passed at sea. This arrangement was not strictly adhered to, the exigencies of the service making it necessary, in some cases, to shorten the period of study. In January, 1846, four months after the opening of the School, the students consisted of 36 Midshipmen, of the date of 1840, who were preparing for the examination for promotion; 13 of the date of 1841, who were to remain until drafted for service at sea; and 7 Acting Midshipmen, appointed since September of the previous year. The Midshipmen of the date of 1840 were the first to be graduated, finishing their limited course in July, 1846, and they were followed in order by the subsequent dates until the reorganization of the School, in 1851.

In September, 1849, a Board was appointed to revise the plan and regulations of the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. Dupont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation July 1, 1850.

The new organization provided for a course of seven years, the first two and last two at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, and its name was changed to the United States Naval Academy. The corps of professors was enlarged, the course was extended, and the system of separate departments, with executive heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Secretary of the Navy. A suitable vessel was attached to the Academy as a practice-ship, and the annual practice-cruises were begun.

After the system had been in operation a year new changes were proposed, and the recommendations of the Academic Board on the subject were referred to the Board of Examiners of the year 1851, composed of the following officers:

Commodore David Conner,
Captain Samuel L. Breese,
Commander C. K. Stribling,
Commander A. Bigelow,
Commander Franklin Buchanan,
Lieutenant Thomas T. Craven.

The change recommended by the Board of Examiners, and adopted by the Department, consisted mainly in leaving out the requirement of three years of sea-service:

middle of the course, thus making the four years of study consecutive. The practice-cruise supplied the place of the omitted sea-service, and gave better opportunity of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in two years, and were graduated in June, 1854; the rest of the class followed in 1855. In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining young Midshipmen were quartered in the Atlantic House and on board the frigates *Albatross* and *Santee*. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to two years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and the machine-shop. This class was graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed the two years' course, somewhat more extended than that of the class of 1868, and was graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which entered the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years instead of two; and the new provision was first applied to the class entering the Academy in the year 1874. This class was graduated in June, 1878.

SUPERINTENDENTS OF THE NAVAL ACADEMY SINCE ITS FOUNDATION.

Named Command—

- Sept. 3, 1845.—Commander Franklin Buchanan.
- Mar. 15, 1847.—Commander George P. Uphur.
- July 1, 1850.—Commander Cornelius K. Stribling.
- Nov. 1, 1853.—Commander Louis M. Goldsborough.
- Sept. 15, 1857.—Captain George S. Blake.
- Sept. 9, 1865.—Rear-Admiral David D. Porter.
- Dec. 1, 1869.—Commodore John L. Worden.
- Sept. 22, 1874.—Rear-Admiral C. R. P. Rodgers.
- July 1, 1878.—Commodore Foxhall A. Parker.
- Aug. 2, 1879.—Rear-Admiral George B. Balch.

BOARD OF VISITORS, JUNE, 1880.

Vice-Admiral S. C. ROWAN, U. S. Navy, *President*.

Professor FRANCIS WAYLAND, <i>Vice-President</i>	New Haven, Conn.
Colonel ARCHIE W. CAMPBELL	Wheeling, W. Va.
General LLOYD ASPINWALL	New York, N. Y.
General W. H. DAVIS	Doylestown, Penn.
Colonel E. B. STODDARD	Worcester, Mass.
Hon. EMERSON ETHERIDGE	Memphis, Tenn.
Hon. NEWTON BOOTH	U. S. Senate.
Hon. ZEBULON B. VANCE	U. S. Senate.
Hon. F. E. BELTZHOOVER	House of Representatives
Hon. C. B. SIMONTON	House of Representatives
Hon. T. C. POUND	House of Representatives

ACADEMIC CALENDAR.

1880--81.

1880.					
Oct.	1.—Beginning of first term				Friday.
1881.					
Jan.	24-29.—Semi-annual examination				Monday-Satur
Jan.	29.—End of first term				Saturday.
June	1-10.—Annual examination				Wednesday-F
June	10.—End of academic year, 1880-81				Friday.
June	11.—Examination of candidates for admission as Cadet-Midshipmen				Saturday.
Sept.	15.—Examination of candidates for admission as Cadet-Engineers				Thursday.
Sept.	22.—Examination of candidates for admission as Cadet-Midshipmen				Thursday.
Oct.	1.—Beginning of first term, 1881-82				Saturday.

The academic months end on the following days:

1880-81.

October	Oct. 30	February	Fe
November	Nov. 27	March	Ma
December	Dec. 25	April	Ap
January	Jan. 22	May	Ma

1881-82.

October	Oct. 29	December	De
November	Nov. 26	January	Ja

CALENDAR FOR 1880-81.

SEPTEMBER.							MARCH.						
Sun.	M.	T.	W.	T.	F.	Sat.	Sun.	M.	T.	W.	T.	F.	Sat.
5	6	7	1	2	3	4	6	7	1	2	3	4	5
12	13	14	15	16	17	18	13	14	15	16	17	18	19
19	20	21	22	23	24	25	20	21	22	23	24	25	26
26	27	28	29	30	.....	.....	27	28	29	30	31	.....	.....
OCTOBER.							APRIL.						
3	4	5	6	7	1	2	3	4	5	6	7	1	2
10	11	12	13	14	15	16	10	11	12	13	14	15	16
17	18	19	20	21	22	23	17	18	19	20	21	22	23
24	25	26	27	28	29	30	24	25	26	27	28	29	30
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
NOVEMBER.							MAY.						
7	1	2	3	4	5	6	1	2	3	4	5	6	7
14	15	16	17	18	19	20	8	9	10	11	12	13	14
21	22	23	24	25	26	27	15	16	17	18	19	20	21
28	29	30	.....	.....	.....	.....	22	23	24	25	26	27	28
.....	.....	.....	.....	.....	.....	.....	29	30	31	.....	.....	.....	.....
DECEMBER.							JUNE.						
5	6	7	1	2	3	4	5	6	7	1	2	3	4
12	13	14	15	16	17	18	12	13	14	15	16	17	18
19	20	21	22	23	24	25	19	20	21	22	23	24	25
26	27	28	29	30	31	.....	26	27	28	29	30	.....	.....
JANUARY.							SEPTEMBER.						
2	3	4	5	6	7	1	4	5	6	7	1	2	3
9	10	11	12	13	14	15	11	12	13	14	15	16	17
16	17	18	19	20	21	22	18	19	20	21	22	23	24
23	24	25	26	27	28	29	25	26	27	28	29	30	.....
30	31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
FEBRUARY.							OCTOBER.						
6	7	1	2	3	4	5	2	3	4	5	6	7	1
13	14	15	16	17	18	19	9	10	11	12	13	14	15
20	21	22	23	24	25	26	16	17	18	19	20	21	22
27	28	.....	.....	.....	.....	.....	23	24	25	26	27	28	29
.....	.....	.....	.....	.....	.....	.....	30	31	.....	.....	.....	.....	.....

OFFICERS
OF THE
UNITED STATES NAVAL ACADEMY.

REAR-ADMIRAL GEORGE B. BALCH,

SUPERINTENDENT.

COMMANDER S. D. GREENE,

Senior Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER F. V. McNAIR,

Commandant of Cadets.

LIEUTENANT W. H. BROWNSON,

Assistant to the Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER E. M. SHEPARD,

Head of Department.

LIEUTENANT-COMMANDER FRANCIS A. COOK,

LIEUTENANT-COMMANDER JOHN SCHOUER,

LIEUTENANT-COMMANDER EDWIN WHITE,

LIEUTENANT E. DE F. HERALD,

LIEUTENANT D. DELEHANTY,

Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,

Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER H. B. ROBESON,

Head of Department.

LIEUTENANT-COMMANDER C. M. THOMAS,

LIEUTENANT W. H. PARKER, Jr.,

LIEUTENANT J. W. MILLER,

LIEUTENANT RICHARD RUSH,

MASTER C. H. LYMAN,

Instructors in Naval Gunnery and Infantry Tactics.

ANTOINE J. CORRESIER,

Sword-Master.

JEAN B. RETZ,

GEORGE HEINTZ,

Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR W. W. HENDRICKSON,

Head of Department.

LIEUTENANT ASA WALKER,
LIEUTENANT BENJAMIN F. TILLEY,
LIEUTENANT F. G. HYDE,
LIEUTENANT S. C. PAINE,
LIEUTENANT H. W. SCHAFER,
MASTER C. W. BARTLETT,

Instructors in Mathematics.

STEAM-ENGINEERING.

CHIEF ENGINEER J. P. SPRAGUE,

Head of Department.

PASSED ASSISTANT ENGINEER W. A. WINDSOR,
PASSED ASSISTANT ENGINEER J. C. KAFFER,
PASSED ASSISTANT ENGINEER R. W. MILLIGAN,
PASSED ASSISTANT ENGINEER J. S. OGDEN,
PASSED ASSISTANT ENGINEER G. H. KEARNEY,
ASSISTANT ENGINEER A. M. MATTICE,
ASSISTANT ENGINEER G. B. RANSOM,

Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

LIEUTENANT-COMMANDER P. F. HARRINGTON,

Head of Department.

LIEUTENANT-COMMANDER C. J. TRAIN,
LIEUTENANT RAYMOND P. RODGERS,
LIEUTENANT WILLIAM J. BARNETTE,

Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

PROFESSOR HENRY D. TODD,

Head of Department.

LIEUTENANT CHARLES BELKNAP,
LIEUTENANT J. B. MURDOCK,
PROFESSOR N. M. TERRY, A. M., PH. D.,
PROFESSOR CHARLES E. MUNROE, S. B.,

Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR J. M. RICE, S. B., PH. D.,

Head of Department.

LIEUTENANT-COMMANDER S. H. BAKER,
LIEUTENANT CHARLES A. STONE,
LIEUTENANT ALEXANDER MCCrackIN,

Instructors in Mechanics and Applied Mathematics.

10 OFFICERS OF THE UNITED STATES NAVAL ACADEMY.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR J. RUSSELL SOLEY, A. B.,

Head of Department.

LIEUTENANT JOHN V. B. BLEECKER,

LIEUTENANT E. D. TAUSIG,

LIEUTENANT GEORGE W. TYLER,

LIEUTENANT M. FISHER WRIGHT,

MASTER CHARLES R. MILES,

PROFESSOR WILLIAM W. FAY, A. M.,

Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,

Head of Department.

MASTER H. L. GREEN,

ASSISTANT PROFESSOR A. V. S. COURCELLE,

ASSISTANT PROFESSOR EUGENE DOVILLIERS,

ASSISTANT PROFESSOR JULES LEROUX,

ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,

Head of Department.

MASTER CORWIN P. REES,

ASSISTANT PROFESSOR C. F. BLAUVELT, N. A.,

Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF

COMMANDER T. F. KANE, *In charge of Practice-Ships.*

MEDICAL INSPECTOR A. C. GORGAS, M. D.

SURGEON M. L. RUTH, M. D.

PASSED ASSISTANT SURGEON M. D. JONES, M. D.

PASSED ASSISTANT SURGEON G. P. LUMSDEN, M. D.

PAY DIRECTOR JAMES D. MURRAY, *Treasurer.*

PAYMASTER L. G. BILLINGS, *Commissary.*

PAYMASTER F. H. SWAN, A. M., *Storekeeper.*

CHAPLAIN J. S. WALLACE, A. M.

ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*

J. J. GRAFF, *Assistant Librarian.*

R. M. CHASE, *Secretary.*

MARINE GARRISON.

CAPTAIN ROBERT W. HUNTINGTON, *Commanding.*

CAPTAIN GEORGE B. HAYCOCK.

FIRST LIEUTENANT W. S. MUSE.

SECOND LIEUTENANT T. G. FILLETTE.

BOATSWAIN C. E. HAWKINS.

GUNNER ROBERT SOMMERS.

MATES.

MURPHY.....	}	<i>Attached to the United States Gunnery-ship Santee and to the sloop-of-war Dale.</i>
L. GEE.....		
AM G. SMITH.....		
HILL.....		
ST SILVER.....	}	<i>Attached to the United States Steamer Nantucket.</i>
MIN G. PERRY.....		<i>Attached to the United States Steamer Phlox (steam-tender).</i>
H ROGERS.....		

ACADEMIC BOARD.

COMMANDER F. V. MCNAIR, U. S. N.
 COMMANDER H. B. ROBESON, U. S. N.
 COMMANDER E. M. SHEPARD, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 CHIEF ENGINEER J. P. SPRAGUE, U. S. N.
 LIEUTENANT-COMMANDER P. F. HARRINGTON, U. S. N.
 PROFESSOR J. M. RICE, PH. D., U. S. N.
 PROFESSOR J. R. SOLEY, A. B., U. S. N.
 PROFESSOR H. D. TODD, U. S. N.
 PROFESSOR L. F. PRUD'HOMME, A. M.
 PROFESSOR MARSHAL OLIVER.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER.

J. L. SCHOCK.

CADET-LIEUTENANTS.

R. B. DASHIELL.	J. L. REES.
J. A. HOOGEWERFF.	F. C. RIDER.

CADET-MASTERS.

H. ELDREDGE, *Adjutant.*

F. E. SUTTON.	J. J. WOODWARD.
F. H. HUNICKE.	E. E. CAPEHART.

CADET-ENSIGNS.

F. E. BUNTS.	G. P. BLOW.
R. P. FORSHEW.	E. CARROLL.

CADET-PETTY-OFFICERS.

First Captains of Gun's Crews.

Mahoney.	W. H. Stayton.	W. F. Flournoy.	R. P. Hains.
many.	J. W. Weeks.	G. G. Rodgers.	H. R. Cohen.
Harrison.	C. P. George.	H. B. Wilson.	E. M. Harmon.
Doyen.	H. K. White.	S. Bryan.	C. H. Lauchheimer.

Second Captains of Gun's Crews.

Oliphant.	W. G. Ford.	F. W. Smies.	H. L. Ballentine.
Kimball.	B. G. Pierce.	J. H. Colwell.	G. M. Buck.
Linnard.	C. W. Stewart.	G. Barnett.	B. H. Craig.
Junkin.	W. A. Gresham.	G. Wilkes.	M. Craven.

CADET-PASSED-ASSISTANT-ENGINEER.

J. M. WHITHAM.

CADET-ASSISTANT-ENGINEERS.

G. KAEMMERLING.

O. B. SHALLENBERGER.

Cadet-Machinists.

Parsons.	F. B. Dowst.	De W. C. Redgrave.	L. B. Perkins.
Smith.	L. Bankson.	J. E. Byrne.	W. T. Webster.

CADET-

Class of 1880

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.	
				Years.	Months.
*1	Alger, Philip Rounseville.....	At large	Sept. 11, 1876	17	0
*2	Dresel, Herman George.....	Ohio	Sept. 18, 1876	17	8
3	Norton, Luman Spooner	Vermont.....	Sept. 12, 1876	17	0
4	Phelps, Harry	New Jersey.....	Sept. 13, 1876	15	7
5	Bernadon, John Baptiste.....	At large	Sept. 12, 1876	17	10
6	Hourigan, Patrick William	New York	June 21, 1876	16	7
7	Ackerman, Albert Ammerman.....	New Jersey.....	June 21, 1876	16	11
8	Wolferberger, William Henry.....	Illinois	Sept. 12, 1876	17	7
9	Poundstone, Homer Clarke.....	West Virginia	Sept. 24, 1874	14	8
10	Haskell, Porter David.....	Michigan	Sept. 12, 1876	17	4
11	Niblack, Albert Parker	Indiana	Sept. 12, 1876	17	2
12	Wilkinson, Ernest	Louisiana	June 19, 1875	17	2
13	Howze, Arthur Robertson	Mississippi	June 21, 1876	15	7
14	Truxtun, William	At large	June 21, 1876	15	3
15	Morgan, Stokely	Arkansas	June 14, 1876	16	11
16	West, George Ernest.....	New York	Sept. 12, 1876	14	5
17	Watters, John Sproston.....	At large	June 21, 1876	14	11
18	Emerson, William Henry	At large	Oct. 10, 1876	16	4
19	Parke, Thomas Aloysius.....	West Virginia	June 21, 1876	16	8
20	Duncan, Louis	Kentucky	Sept. 11, 1876	15	6
21	Muir, William Carpenter Pendleton	Kentucky	June 21, 1876	17	3
22	Cabanias, Charles	Virginia	June 21, 1876	16	8
23	Haeseler, Francis Joy.....	Pennsylvania	Sept. 12, 1876	16	5
24	Van Duzer, Louis Sayre.....	New York	Sept. 13, 1876	15	3
25	Rohrbacher, Joseph Hamilton	Pennsylvania	June 21, 1876	17	9
26	Beale, Joseph	Pennsylvania	Oct. 12, 1874	14	10
27	Simpson, Edward, Jr.	Pennsylvania	June 21, 1876	17	8
28	Drake, James Calhoun	Arkansas	June 19, 1875	17	11
29	Dickson, Joseph Morrill	Texas	June 14, 1876	15	5
30	Dillman, George Lincoln	Iowa	June 19, 1876	16	1
31	Bowdon, Frank Welch	Texas	Sept. 11, 1875	17	7
32	Mayer, Augustus Newkirk	Iowa	June 17, 1876	17	3
33	Sims, William Sowden	At large	June 21, 1876	15	9
34	Buchanan, Wilson Wildman	Ohio	June 19, 1875	17	3
35	Leiper, Edwards Fayssoux.....	Pennsylvania	June 21, 1875	16	7
36	Brainard, Fred Roland	Illinois	June 21, 1876	17	9
37	Safford, William Edwin	Ohio	Sept. 11, 1876	16	9
38	Eyre, Manning Kennard	At large	Sept. 11, 1876	15	6
39	Gorgas, Miles Carpenter.....	At large	Sept. 11, 1875	14	3
40	Scott, Richard Hamilton	Minnesota	June 21, 1876	17	9
41	Wall, Francis Richardson.....	Mississippi	June 23, 1876	16	11
42	Finley Henry Marzette.....	Ohio	June 21, 1875	16	3

PMEN.

nders.

Order of merit in—										Sea-service in practice-ships.		Order of general merit.
Ship-building.	Ordnance.	Marine engines.	Theoretical navigation.	Practical navigation.	Heut.	Naval architecture (elective).	Public law.	Spanish.	Number of demerits.	Months.	Days.	
4	2	2	2	1	2	1	3	8	148	5	4	*1
1	1	4	3	2	1	2	4	4	89	5	4	*2
6	6	5	7	7	7	4	25	19	141	5	4	3
7	4	1	1	3	5	5	15	5	88	5	4	4
8	3	14	18	15	10	2	25	2	189	5	4	5
10	12	18	5	11	3	.....	1	20	144	5	4	6
2	8	11	10	22	9	7	30	37	92	5	4	7
21	10	12	8	5	8	.....	11	15	57	5	4	8
2	7	10	4	4	5	.....	10	9	93	5	8	9
22	18	14	11	11	15	.....	17	11	48	5	4	10
11	4	13	12	24	27	.....	8	32	62	5	4	11
43	34	9	12	27	17	.....	37	7	103	5	5	12
25	24	28	5	13	19	8	22	2	24	5	4	13
9	9	8	14	17	12	6	4	53	72	5	4	14
15	26	26	9	10	25	.....	19	32	68	5	4	15
40	42	29	24	8	14	9	22	15	111	5	4	16
5	18	22	30	20	11	.....	38	20	140	5	4	17
26	17	7	22	6	3	.....	46	13	94	5	4	18
31	22	17	14	18	19	.....	21	11	60	5	4	19
12	14	6	18	9	15	.....	25	23	107	5	4	20
32	21	20	22	33	19	.....	33	23	102	5	4	21
13	15	20	32	28	25	.....	17	10	27	5	4	22
15	12	19	17	13	43	.....	42	47	94	5	4	23
18	29	14	18	23	17	.....	14	50	68	5	4	24
36	29	37	39	39	22	.....	12	22	94	5	4	25
42	54	46	28	40	32	.....	15	27	143	5	4	26
15	11	31	25	33	27	.....	42	39	86	5	4	27
26	40	32	16	20	29	.....	54	29	138	5	4	28
44	22	24	27	35	22	.....	2	26	51	5	4	29
59	41	47	53	38	59	.....	56	28	155	5	4	30
28	31	53	42	44	40	.....	4	17	57	5	4	31
34	26	38	29	32	34	.....	33	37	127	5	4	32
14	16	3	26	30	12	.....	24	29	146	5	4	33
24	34	34	37	24	34	.....	47	29	81	5	5	34
18	24	25	35	36	38	.....	29	42	74	5	4	35
44	20	27	45	15	30	.....	59	46	113	5	4	36
33	45	32	43	50	33	.....	41	1	98	5	4	37
39	36	35	36	24	34	.....	42	14	149	5	4	38
53	48	39	41	42	44	.....	60	6	105	5	5	39
28	32	23	31	37	22	.....	25	29	127	5	4	40
51	38	42	38	28	38	.....	19	17	136	5	4	41
46	48	29	18	18	48	.....	13	32	159	5	4	42

CADET-

Class of 1880—62

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.	
				Years.	Months.
43	Fillebrown, Horatio Ladd	South Carolina	June 19, 1875	16	1
44	Worthington, Thomas	Alabama	June 19, 1876	16	7
45	Maxwell, William John	At large	June 9, 1874	15	2
46	Huntoon, Fitz-Aubert	Texas	Sept. 15, 1875	16	10
47	Swift, Franklin	Massachusetts	June 9, 1874	16	1
48	Hill, Charles Homer	Wisconsin	Sept. 14, 1875	16	0
49	French, George Ross	At large	June 21, 1875	17	11
50	Ashmore, Henry Beckwith	At large	Oct. 3, 1876	15	4
51	Gray, James	Illinois	Sept. 12, 1876	17	0
52	Dewey, Theodore Gibbs	South Carolina	June 19, 1875	16	0
53	Cramer, Ambrose	Maryland	Sept. 28, 1874	17	0
54	Luby, John Frazer	New York	June 21, 1875	17	11
55	Richardson, Walter Gates	Massachusetts	Sept. 12, 1876	16	9
56	Clark, Lewis Jacob	Alabama	Sept. 11, 1876	14	7
57	Nash, Edwin White	Ohio	Sept. 11, 1876	16	11
58	Brown, James Stephen	Tennessee	Sept. 11, 1875	17	2
59	Belmont, Oliver Hazard Perry	New York	Sept. 30, 1874	14	10
60	Brinley, Edward	At large	Sept. 18, 1876	16	3
61	Rodman, Hugh	Kentucky	Sept. 13, 1875	16	8
62	Bullitt, Howard Henry	Kentucky	Sept. 11, 1875	17	11

MIDSHIPMEN.

members—Continued.

Seamanship.	Ship-building.	Ordnance.	Marine engines.	Theoretical navigation.	Practical navigation.	Heut.	Naval architecture (elective.)	Public law.	Spanish.	Number of demerits.	Sea-service in practice-ships.		Order of general merit.
											Months.	Days.	
56	60	52	39	49	56	54	.....	58	44	106	5	4	43
10	20	33	56	51	50	50	.....	32	32	97	5	4	44
24	23	36	60	55	59	58	.....	38	55	88	5	4	45
44	36	42	42	32	45	42	.....	52	52	139	5	4	46
35	40	46	39	43	40	44	.....	38	56	115	5	5	47
13	36	48	36	57	58	50	.....	9	49	155	4	16	48
54	52	53	54	61	50	31	.....	33	47	131	7	23	49
38	34	60	45	39	54	41	.....	52	25	154	5	4	50
51	56	28	51	46	50	56	.....	7	58	127	5	4	51
58	54	46	55	51	56	47	.....	50	62	94	5	4	52
48	50	56	58	56	46	50	.....	47	60	118	5	5	53
29	30	39	50	50	48	54	.....	33	43	144	5	5	54
60	62	48	47	60	48	49	.....	30	26	140	5	4	55
53	49	59	57	47	30	28	.....	50	60	153	5	4	56
54	48	54	44	32	43	46	.....	45	50	166	5	4	57
47	57	61	59	48	60	57	.....	57	57	153	5	4	58
48	60	62	61	62	62	60	.....	62	44	144	5	5	59
61	55	42	52	53	46	62	.....	49	39	52	5	4	60
58	46	56	47	58	54	50	.....	55	58	117	5	4	61
62	58	58	62	58	61	60	.....	61	54	98	5	4	62

RELATIVE STANDING.

C

First

Order of annual merit.	Name.	State.	Date of admission.	Age at admission
				Years.
23	Andrews, Horace Burlingame	Michigan	June 22, 1876	15
35	Ballentine, Henry Laird	Tennessee	June 20, 1877	16
28	Barnett, George	Wisconsin	June 19, 1877	17
37	Blow, George Preston	Virginia	Sept. 14, 1876	15
68	Bonfile, Thomas Lewis	Missouri	June 19, 1875	17
54	Bryan, Samuel	Maryland	June 14, 1876	17
39	Buck, Guy Morville	Maine	Sept. 11, 1877	16
14	Bunte, Frank Emory	Ohio	June 20, 1877	16
11	Capehart, Edward Everett	Ohio	June 22, 1877	17
12	Carroll, Eugene	At large	June 19, 1877	16
55	Clarke, George	Illinois	June 22, 1877	14
52	Cockle, Rudolphus Rouse	Illinois	June 21, 1875	17
43	Cohen, Harry Radcliffe	At large	June 20, 1877	15
40	Colwell, James Hall	At large	June 20, 1877	16
65	Craig, Ben Holliday	Missouri	June 14, 1876	16
56	Craven, Macdonough	New York	June 21, 1876	17
58	Crenshaw, James Davis	Texas	Sept. 11, 1877	17
9	Dashiell, Robert Brooke	At large	June 19, 1877	16
57	Donnelly, Michael Joseph	Wisconsin	June 21, 1877	17
20	Doyen, Charles Augustus	New Hampshire	June 21, 1876	16
64	Dresser, James Walter	Minnesota	June 21, 1877	16
15	Eldredge, Houston	At large	Oct. 2, 1876	15
49	Emmet, William Le Roy	At large	June 20, 1876	16
37	Flournoy, William Francis	Louisiana	June 19, 1877	17
45	Ford, William Griffing	Arkansas	Sept. 11, 1877	15
19	Forshew, Robert Pierpont	New York	June 21, 1876	16
43	George, Charles Peaslee	Illinois	July 1, 1876	16
66	Gresham, William Albert	Indiana	June 19, 1875	17
34	Haines, Henry Cargill	At large	June 20, 1875	15
53	Hains, Robert Peter	Maine	Sept. 18, 1876	16
46	Harmon, Eugene Marion	Ohio	June 20, 1877	17
25	Harrison, Edward Hasson	At large	June 21, 1877	15
18	Hasson, Alexander Ritchie	At large	June 21, 1875	15
4	Hoogewerff, John Adrian	At large	June 21, 1877	16
24	Hunicke, Felix Harman	Missouri	Sept. 11, 1877	17
7	Karmany, Lincoln	Pennsylvania	Sept. 12, 1877	17
51	Kase, Spencer Mettler	Illinois	Sept. 11, 1877	17
36	Kimball, John Arthur	Massachusetts	Sept. 12, 1877	17
17	Lauchheimer, Charles Henry	Maryland	Sept. 11, 1877	17
77	Lindsay, John Howard	Pennsylvania	June 21, 1876	16
3	Linnard, Joseph Hamilton	Pennsylvania	June 21, 1877	16
30	Mahoney, James Edward	Massachusetts	Sept. 12, 1876	16
63	Matthews, Thomas Henry	Pennsylvania	Sept. 12, 1876	16
59	McCrea, Alexander Sterling	At large	Oct. 2, 1876	17

SHIPMEN.

members.

Seaman.	Order of merit in—							Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
	Naval tactics.	Ordnance instructions and infantry tactics.	Astronomy.	Heat and light.	Mechanics and applied mathematics.	Composition.	French.		Months.	Days.	
24	8	37	22	18	44	37	11	84	4	12	23
35	34	51	41	27	39	17	30	131	4	12	35
21	28	34	19	23	44	37	61	31	4	12	28
9	17	4	32	42	26	23	60	158	4	12	37
73	37	73	52	56	56	76	76	160	4	28	68
50	18	48	52	50	48	57	41	127	4	12	54
47	21	61	38	23	49	66	56	35	4	12	39
7	7	29	25	13	20	29	17	26	4	12	14
14	27	26	11	11	14	45	8	68	4	12	11
33	23	22	9	19	10	15	29	103	4	12	12
68	44	56	34	42	27	57	63	148	4	12	55
25	71	45	43	61	54	20	53	185	4	12	52
17	14	29	43	49	68	42	44	60	4	12	42
44	49	26	32	29	60	66	43	80	4	12	40
59	56	77	68	53	62	64	55	123	4	12	65
5	40	45	63	74	60	44	44	180	4	12	56
39	77	49	39	64	34	77	47	113	4	12	58
1	2	1	15	16	13	4	3	25	4	12	*9
58	52	49	45	25	68	73	42	100	4	12	57
20	35	10	17	34	21	24	13	155	4	12	20
63	67	65	58	68	32	61	67	181	4	12	64
8	11	3	21	32	30	14	15	71	4	12	15
45	32	36	34	68	25	37	77	188	4	12	42
74	43	43	29	20	39	35	6	122	4	12	37
55	50	8	34	31	68	54	53	90	4	12	45
31	25	12	18	22	30	10	21	31	4	12	19
37	48	15	63	35	50	50	50	85	4	12	48
56	39	56	73	58	77	33	63	76	4	28	66
29	47	14	41	44	27	20	37	133	4	12	34
60	55	16	49	40	51	45	50	147	4	12	53
17	53	41	30	56	64	24	37	189	4	12	46
21	5	40	49	17	17	50	67	93	4	12	25
28	37	20	13	12	19	33	47	187	4	28	18
9	5	6	5	2	6	6	18	89	4	12	*4
34	42	18	52	48	17	12	7	68	4	12	24
6	46	21	2	5	16	2	3	49	4	12	*7
66	70	62	27	51	44	31	25	42	4	12	51
21	44	37	24	38	34	45	36	180	4	12	36
27	58	18	26	10	23	41	8	150	4	12	17
77	78	72	75	70	71	45	70	174	4	12	77
11	12	24	3	6	2	12	10	94	4	12	*3
25	16	17	59	37	53	19	15	74	4	12	30
72	61	64	60	53	38	63	34	212	4	12	63
62	61	66	69	60	55	28	12	183	4	12	69

C

First class

Order of annual merit.	Names.	State.	Date of admission.	Age at date admission	
				Years.	Months.
48	McJunkin, Ira.....	Pennsylvania.....	June 20, 1877	17	
75	McKee, Llewellyn Thomas.....	Pennsylvania.....	June 20, 1877	17	
76	Morgan, Daniel.....	Kentucky.....	Sept. 11, 1877	17	
26	Moses, Franklin James.....	South Carolina.....	Sept. 11, 1877	16	
71	Oliphant, Alexander Coulter.....	New Jersey.....	Sept. 12, 1877	17	
70	Orlopp, Max Anton.....	Arkansas.....	June 19, 1878	17	
62	Parker, Felton.....	Iowa.....	Nov. 6, 1878	16	
60	Parsons, Arthur Carlton.....	Iowa.....	June 21, 1878	17	
31	Perkins, Con Marraat.....	Georgia.....	Sept. 11, 1875	14	
72	Perry, George Ernest.....	Illinois.....	Sept. 12, 1878	16	
29	Pierce, Byron Gilmore.....	Illinois.....	June 21, 1877	17	
50	Printup, David Lawrence.....	New York.....	June 21, 1877	17	
*6	Rees, John Livermore.....	Michigan.....	June 21, 1877	17	
*5	Rider, Frederic Clinton.....	Rhode Island.....	Sept. 12, 1877	17	
44	Robinson, William Moody.....	At large.....	June 23, 1878	17	
61	Rodgers, Guy George.....	Tennessee.....	Sept. 23, 1878	14	
60	Russell, William Worthington.....	At large.....	Sept. 12, 1878	17	
*1	Schook, John Loomis.....	Pennsylvania.....	June 19, 1877	17	
16	Serata, Tasuker.....	Empire of Japan.....	Sept. 12, 1877	19	
32	Smiles, Frederick William.....	Ohio.....	June 22, 1877	16	
13	Stayton, William Henry.....	Delaware.....	June 21, 1877	16	
47	Stewart, Charles West.....	Illinois.....	June 21, 1877	17	
*8	Sutton, Francis Eskridge.....	New York.....	June 21, 1877	16	
33	Urin, Sotokichi.....	Empire of Japan.....	Sept. 12, 1877	19	
74	Vance, Zebulon Baird.....	North Carolina.....	June 22, 1878	16	
38	Weeks, John Wingate.....	New Hampshire.....	June 21, 1877	17	
41	Weller, Ovington Eugene.....	Maryland.....	Sept. 12, 1877	15	
10	White, Harry Kidder.....	Dakota.....	Sept. 10, 1877	17	
21	Wilkes, Gilbert.....	Utah.....	Sept. 12, 1877	14	
67	Williamson, Samuel Hill.....	North Carolina.....	Sept. 11, 1878	17	
23	Wilson, Henry Braid.....	New Jersey.....	Sept. 11, 1878	15	
*2	Woodward, Joseph Janvier.....	At large.....	June 21, 1877	16	
73	Wright, Silas Haynes.....	Michigan.....	June 28, 1878	17	

EN.

Continued.

Order of merit in—							Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
Naval tactics.	Ordnance instructions and infantry tactics.	Astronomy.	Heat and light.	Mechanics and applied mathematics.	Composition.	French.		Months.	Days.	
59	9	75	46	76	3	30	25	4	12	48
71	66	70	75	71	68	74	177	4	28	75
76	78	71	63	66	62	74	118	4	12	76
25	43	27	15	15	71	50	166	4	12	26
66	69	71	65	74	65	70	30	4	12	71
69	70	63	53	52	78	72	194	4	12	70
41	53	62	77	71	24	1	217	4	12	62
74	53	49	70	56	15	72	125	4	12	60
31	13	19	58	22	42	25	99	4	12	31
61	71	67	73	62	32	56	187	5	0	72
29	29	14	20	39	22	49	175	4	28	29
53	53	37	46	39	56	40	112	4	12	50
8	4	6	14	5	1	13	157	4	12	*6
21	10	8	7	4	4	25	110	4	12	*5
64	32	48	38	33	72	66	102	4	12	44
28	52	66	61	64	70	34	189	4	12	61
68	74	77	65	66	60	3	218	4	12	69
3	2	1	1	1	9	23	76	4	12	*1
51	66	12	32	7	54	63	65	4	12	16
18	35	30	30	34	29	32	128	4	12	32
60	33	23	8	9	53	24	173	4	12	13
32	59	58	41	37	45	20	193	4	12	47
10	28	7	3	8	10	2	57	4	12	*8
15	59	45	45	39	8	32	47	4	12	33
65	74	61	76	56	74	67	199	5	0	74
35	22	52	26	44	50	62	73	4	12	38
23	47	39	52	27	24	18	165	4	12	41
4	25	9	9	10	17	22	49	4	12	10
30	37	16	36	24	35	37	146	4	12	21
74	63	57	67	59	69	46	127	4	12	67
13	41	45	28	12	40	56	151	4	12	23
1	6	4	3	3	6	25	58	4	12	*2
57	56	73	72	75	75	56	109	4	12	73

C

Second d

Order of annual merit.	Name.	State.	Date of admission.	Age at admission	
				Years.	Months.
20	Anderson, Edwin Alexander.....	North Carolina	June 21, 1878	17	
3	Arnold, John Thompson.....	Wyoming Territory....	Sept. 27, 1877	17	
29	Bell, Everett Nelson.....	Tennessee	Aug. 23, 1877	17	
4	Bennett, Louis Slocum.....	New Jersey.....	Sept. 11, 1877	15	
14	Blandin, John Joseph.....	Alabama.....	June 21, 1878	15	
26	Conway, John Joseph.....	New York.....	Sept. 11, 1877	17	
16	Doyle, James Gregory.....	Pennsylvania.....	June 21, 1877	17	
31	Dudley, Charles Jackson.....	Georgia.....	Sept. 11, 1877	17	
25	Duncan, William Butler.....	New York.....	Nov. 1, 1878	16	
28	Eames, Harold Hayden.....	Maine.....	June 21, 1878	14	
6	Field, Wiley Roy Mason.....	Virginia.....	June 21, 1878	15	
7	Fletcher, William Bartlett.....	Vermont.....	Sept. 11, 1877	15	
33	Fowler, Hammond.....	Virginia.....	Sept. 23, 1878	16	
21	Grambs, William Jacob.....	Pennsylvania.....	Sept. 11, 1877	15	
32	Gwyn, Lawrence Sangaton.....	Mississippi.....	June 21, 1878	16	
9	Horst, Henry August.....	Alabama.....	June 21, 1878	17	
11	Howard, William Lauriston.....	Connecticut.....	Sept. 11, 1877	17	
30	Hubbard, Nathaniel Mead.....	At large.....	Sept. 11, 1877	17	
35	Jayne, Joseph Lee.....	Mississippi.....	June 21, 1878	15	
8	Johnston, Marbury.....	Georgia.....	Sept. 23, 1878	17	
12	Kenkel, Herman Henry.....	Minnesota.....	June 21, 1878	17	
36	Kent, George Edward.....	New York.....	June 21, 1877	16	
23	Key, Albert Lenoir.....	Tennessee.....	June 21, 1877	16	
15	King, William Nephew, jr.....	Georgia.....	June 21, 1878	17	
34	Lodeman, Frank Felix Emile.....	Michigan.....	June 21, 1878	14	
24	Martin, Clarence.....	Louisiana.....	June 21, 1878	16	
38	McGiffen, Philo Norton.....	Pennsylvania.....	Sept. 11, 1877	16	
	McNutt, Finley Alexander.....	Indiana.....	Sept. 11, 1877	16	
17	McWhorter, Jacob Gray.....	Georgia.....	Sept. 12, 1877	16	
*1	Nixon, Lewis.....	Virginia.....	June 21, 1878	17	
18	Paine, Walter Taylor.....	Ohio.....	Sept. 11, 1877	14	
37	Patterson, Samuel Achmuty Wainwright..	At large.....	June 21, 1878	16	
27	Poyer, John Martin.....	At large.....	June 21, 1877	15	
19	Prince, Thomas Clayton.....	Ohio.....	June 21, 1878	17	
22	Savage, Ledru Rollin.....	Illinois.....	Sept. 23, 1878	17	
10	Semple, Lorenzo.....	Alabama.....	Sept. 11, 1877	16	
29	Stahle, Frederick Henry.....	California.....	Sept. 11, 1877	15	
5	Sutphen, Edson Webster.....	Nebraska.....	June 21, 1878	17	
13	Whittelsey, William Bailey.....	New York.....	June 21, 1878	17	
2	Wood, Spencer Shepard.....	New York.....	June 21, 1878	16	

N.

Trigonometry.	Order of merit in—						Number of demerita.	Sea-service in practice-ships.		Order of annual merit
	Analytical geometry.	Descriptive geometry.	Physics and chemistry.	History and rhetoric.	French.	Drawing.		Months.	Days.	
28	18	12	11	11	17	22	144	4	9	20
3	2	1	2	23	29	8	225	4	9	3
45	32	38	44	15	47	25	185	4	9	39
7	13	15	3	2	4	20	154	4	9	4
29	20	20	12	5	10	18	227	4	9	14
30	28	37	40	7	14	30	154	4	9	26
22	14	18	8	17	37	16	176	4	9	16
27	31	13	40	39	31	42	201	4	9	31
33	26	23	18	45	1	34	253	4	9	25
26	38	20	25	32	21	7	250	4	9	28
9	3	10	16	9	8	39	156	4	9	6
12	11	7	7	3	20	11	78	4	9	7
48	35	41	36	29	23	29	221	4	9	33
19	16	25	20	28	31	4	235	4	9	21
47	11	40	28	37	23	48	158	4	9	32
12	21	26	4	13	2	19	104	4	9	9
10	24	14	34	19	8	10	138	4	9	11
34	25	28	32	25	27	23	250	4	9	30
24	17	6	14	25	40	15	253	4	9	35
5	4	9	6	15	15	26	174	4	9	8
4	23	5	13	37	36	3	158	4	9	12
32	38	16	37	40	40	6	214	4	9	36
21	10	30	19	11	25	41	240	4	9	23
15	30	22	27	10	7	16	248	1	23	15
46	33	42	38	43	18	33	236	4	9	34
10	22	36	28	24	11	44	124	4	9	24
40	40	44	31	34	34	47	174	4	9	38
16	.....	.....	.....	.....	.....	.....	85	4	9	.....
8	9	19	22	18	29	38	204	4	9	17
1	1	1	1	1	9	14	171	4	9	*1
18	6	32	25	31	6	32	102	4	9	18
36	37	30	32	36	42	37	230	4	9	37
16	29	33	24	5	16	45	262	4	9	27
25	27	7	10	21	19	11	75	4	9	19
23	15	16	20	20	26	40	96	4	9	22
19	7	29	14	13	4	21	190	4	9	10
31	35	35	30	25	12	28	237	4	9	29
5	8	3	16	7	28	1	107	4	9	5
14	18	10	9	22	39	13	96	4	9	13
2	5	4	5	4	13	2	47	4	9	2

Order of annual merit.	Name.		State.	
13	Agee, Alfred Pelham.....	Alabama.....	J	
36	Alexander, Robert Colder.....	Kentucky.....	8	
:	Ashby, Stephen.....	Kentucky.....	J	
18	Balthis, Harry Hamilton.....	Illinois.....	J	
†	Barkley, Richard Warren.....	Missouri.....	J	
22	Barnard, John Hall.....	New York.....	8	
5	Bowman, William Ezekiel.....	Michigan.....	8	
14	Brady, Cyrus Townsend.....	Kansas.....	8	
43	Carpenter, James Franklin.....	Indiana.....	8	
21	Chapin, Frederick Lincoln.....	Illinois.....		
37	Colvin, Frank Reginald.....	New York.....		
33	Cooper, James Jackson Gignilliat.....	Florida.....		
19	Dalrymple, Elton Wesley.....	Iowa.....		
39	Dovalé, Arthur.....	New York.....		
12	Frazier, Robert Thomas.....	Tennessee.....		
17	George, Harry.....	Michigan.....		
6	Gignilliat, Thomas Heywood.....	Georgia.....		
30	Gray, Willie Theodore.....	North Carolina.....		
*1	Greene, Samuel Dana, jr.....	Rhode Island.....		
†	Hayden, Thomas Warren.....	Massachusetts.....		
9	Hepp, Charles Frederick.....	Missouri.....		
23	Jackson, John Alexander.....	Florida.....		
*3	Jackson, John Brinckerhoff.....	New Jersey.....		
15	Keith, Albion Sherman.....	Massachusetts.....		
7	Kiefer, Edmund Emerson.....	Pennsylvania.....		
45	Ledbetter, William Hamilton.....	Texas.....		
24	Legaré, Alexander Brown.....	South Carolina.....		
20	Lennon, Michael Edward.....	Wisconsin.....		
35	Lerch, Robert Lee.....	Ohio.....		
16	Megrath, William Alonzo.....	Georgia.....		
29	Mitchell, Sidney Zollicoffer.....	Alabama.....		
:	Morris, Walter Ellis.....	Pennsylvania.....		
31	O'Leary, Timothy Stephen.....	Massachusetts.....		
46	Parker, Foxhall Alexander.....	Iowa.....		
42	Pettit, Harry Corbin.....	Indiana.....		
11	Philbin, Patrick Henry.....	Maryland.....		
§	Phythian, Charles Taylor.....	Kentucky.....		
32	Reynolds, Charles Roberts.....	Arizona Territory.....		
33	Ricketts, William Wallace.....	Virginia.....		
†	Schrader, George Morrison von.....	Missouri.....		
41	Smith, Thomas Buchanan.....	Alabama.....		
†	Smythe, James Wilson.....	New York.....		
44	Solomon, Edward Everett.....	Georgia.....		
25	Stout, George Clymer.....	Pennsylvania.....		
*2	Street, George Washington.....	Wisconsin.....		

† Reinstated in accordance with an act of Congress.

; Turned back from present seat

THIRD CLASS.

23

SHIPMEN.

Members.

1881.	at date of admission.	Order of merit in—					Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
		Seamanship.	Mathematics.	English and history.	French.	Drawing.		Months.	Days.	
16	10	13	9	14	33	40	136	2	12	13
16	21	49	38	29	34	4	70	2	12	36
16	8									‡
17	8	13	21	12	35	20	96	2	12	18
16	3									†
17	2	5	27	35	11	2	191	2	12	22
16	3	7	5	4	4	15	91	2	12	5
17	9	29	17	6	6	18	275	2	12	14
15	7	39	48	35	46	34	145	2	12	43
16	3	21	32	32	18	6	60	2	12	21
17	2	53	38	18	26	45	97	2	12	37
16	7	37	30	14	40	43	178	2	12	33
16	4	36	12	25	22	30	196	2	12	19
17	10	52	37	47	7	34	184	2	12	39
16	4	10	15	7	10	34	106	2	12	12
16	1	21	18	9	24	27	145	2	12	17
15	7	6	6	21	28	1	120	2	12	6
18	0	17	27	33	21	20	121	2	12	30
14	7	1	2	1	1	20	70	2	12	+1
16	8									‡
17	2	8	22	10	11	3	48	2	12	9
17	11	18	29	11	20	37	158	2	12	23
17	1	4	4	2	2	11	48	2	12	+3
16	5	21	14	22	22	7	78	2	12	15
16	4	32	7	24	17	31	129	2	12	7
17	8	55	46	41	29	52	126	2	12	45
18	0	42	19	38	24	12	144	2	12	24
16	10	33	23	7	46	31	105	2	12	20
16	3	30	38	27	9	33	36	2	12	35
17	4	18	8	31	37	28	121	2	12	16
16	6	27	24	30	8	37	181	2	12	29
16	6									‡
18	0	21	35	32	16	15	91	2	12	31
17	3	47	47	46	52	58	161	2	12	46
15	10	45	43	40	55	29	131	2	12	42
17	8	25	11	20	18	10	153	2	12	11
16	8									§
15	6	41	25	43	32	14	72	2	12	32
17	10	34	20	42	44	40	72	2	12	33
16	5									†
17	8	43	43	33	37	56	299	2	12	41
16	5									‡
18	0	53	36	37	54	57	232	2	12	44
17	2	27	31	19	35	9	83	2	12	25
16	7	2	1	3	11	25	76	2	12	*2

§ Reinstated.

Third cl

Order of annual merit.	Name.	State.	Date
			ma
*4	Sweeting, Charles Edward	New York	Sept.
38	Temple, Edwin George	Wisconsin	Sept.
10	Thurston, Benjamin Eaton	Indiana	Sept.
28	Toney, Tremlet Vivian	Illinois	June
27	Weeks, Edwin Babbitt	Oregon	Sept.
40	Wilson, William Joseph	Ohio	Sept.
25	Witherspoon, Thomas Alfred	Tennessee	June
8	Woods, Robert Harris	Virginia	Sept.

DESHIPMEN.

members—Continued.

Age at date of admission.		Order of merit in—					Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
Years.	Months.	Seamanship.	Mathematics.	English and history.	French.	Drawing.		Months.	Days.	
17	11	9	3	5	15	8	185	2	12	*4
17	8	46	42	14	43	48	52	2	12	38
15	5	30	10	27	5	4	46	2	12	10
17	8	12	33	17	37	25	110	2	12	28
15	3	16	15	39	11	40	252	2	12	27
17	11	39	38	48	44	44	54	2	12	40
17	2	3	26	26	41	23	76	2	12	25
17	10	10	13	13	2	17	64	2	12	8

RELATIVE STANDING.

CADET-MIDSHIPMEN.

Fourth class—51 members.

Name.	State.	Date of admission.	Age at date of admission.		Sea- s in pr ships
			Years.	Months.	
Atwood, John Cowan	Missouri	June 11, 1880	17	0	1
Barker, William Alfred	Colorado	Sept. 22, 1880	16	6	0
Beecher, Albert Morrison	Iowa	June 11, 1880	17	4	1
Blake, Henry Davis	North Carolina	Sept. 20, 1880	18	0	0
Buah, William Wirt, jr	New York	Sept. 22, 1880	15	8	0
Carter, Vanix	Pennsylvania	Sept. 22, 1880	17	1	0
Cassidy, Edward Rochfort	New York	Sept. 12, 1879	17	11	0
Cook, William Ellsworth	Ohio	Sept. 30, 1880	18	0	0
Curtis, Frederic Ellsworth	Massachusetts	Sept. 22, 1880	17	8	0
Davis, James Sherlock	Ohio	June 11, 1880	17	9	1
Friedlander, Harry	California	Sept. 22, 1880	17	11	0
Ganong, William Gilbert	Wisconsin	Mar. 29, 1880	18	0	1
Gilmer, William Wirt	Virginia	June 11, 1880	17	0	1
Harrell, John Randolph	Louisiana	Sept. 22, 1880	16	7	0
Hayes, Charles Harold	Pennsylvania	Sept. 22, 1880	16	8	0
Hazeltine, Charles Walter	Missouri	June 11, 1880	17	2	1
Hoggatt, Wilford Bacon	Indiana	June 11, 1880	14	9	1
Jastremski, Leon Henry	Louisiana	Sept. 22, 1879	14	11	1
Jones, Hilary Pollard, jr	Virginia	Sept. 22, 1880	16	10	0
Johnston, William	Mississippi	June 11, 1880	17	10	1
Lamison, Jason Gordon	Ohio	June 11, 1880	16	5	1
Leary, Thomas Horton	North Carolina	Sept. 22, 1880	16	11	0
Lovenskiold, Arlington Lee	Texas	Sept. 29, 1880	17	10	0
McCook, John Anson	New York	Sept. 30, 1880	17	2	0
McCord, Harry Herrick	New York	June 11, 1880	15	5	1
McCreary, Wirt	Pennsylvania	June 11, 1879	17	1	0
McDonald, John Daniel	Nevada	Oct. 6, 1880	16	11	0
McIntire, Alonzo Evans	Massachusetts	Sept. 22, 1879	15	0	1
McKean, Josiah Slatts	Ohio	Sept. 22, 1879	15	3	0
McNulta, Herbert	Illinois	June 11, 1880	17	6	1
Macpherson, Victor	Kentucky	Sept. 22, 1880	15	3	0
Maxcy, John Wharton	Texas	June 11, 1880	16	5	1
Mitchell, Charles Ryan	Georgia	Sept. 22, 1879	17	9	0
Moseley, Nathaniel Stockwell	California	Mar. 22, 1880	18	.....	1
O'Malley, William Ambrose	Pennsylvania	Sept. 22, 1880	17	4	0
Plunkett, Charles Peshall	Dist. of Columbia	Sept. 30, 1879	15	7	0
Raichle, Frank Godfrey	New York	June 11, 1880	16	11	1
Sargent, Frederic Homer	Illinois	June 11, 1880	17	6	1
Seymour, Isaac Knight	Maine	Sept. 22, 1880	17	6	0
Shoemaker, William Rawle	New Mexico	June 11, 1880	17	4	1
Sloan, Albert Brown	Missouri	Sept. 22, 1880	17	8	0
Smith, Sidney Fuller	Massachusetts	Sept. 22, 1880	16	11	0
Sparling, Frederick Herbert	Washington Ter	Dec. 29, 1879	18	.....	1
Stevens, Raymond Rodgers Watmough Bliss	Kentucky	Nov. 18, 1879	18	0	1

FOURTH CLASS.

27

CADET-MIDSHIPMEN.

Fourth class—51 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.		Sea-service in practice-ships.	
			Years.	Months.	Months.	Days.
Terrell, Douglass Fuqua.....	Mississippi.....	Sept. 22, 1880	17	3	0	0
Venable, Charles.....	Georgia.....	Sept. 22, 1880	17	0	0	0
Welles, Roger, jr.....	Connecticut.....	Sept. 22, 1880	17	9	0	0
Williams, Clarence Stewart.....	Ohio.....	Sept. 22, 1880	16	11	0	0
Williams, William Plumb.....	Connecticut.....	June 11, 1880	17	11	1	23
Wirt, William Edgar.....	Ohio.....	Sept. 22, 1880	17	9	0	0
Wood, John Whitaker.....	North Carolina.....	Sept. 22, 1880	16	11	0	0

CADET-

Graduating class of

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.	
				Years.	Months.
*1	Stahl, Albert William	New York	Sept. 14, 1876	19	4
*2	Durand, William Frederick	Connecticut	Sept. 14, 1876	17	6
3	Hasson, William Frederick Converse	Ohio	Sept. 14, 1876	19	4
4	Miner, Leo Dwight	Ohio	Sept. 14, 1876	17	7
5	Sample, Winfield Scott	Pennsylvania	Sept. 14, 1876	18	10
6	Woods, Arthur Tannatt	Massachusetts	Sept. 14, 1876	17	7
7	Wood, Joseph Learned	Virginia	Sept. 14, 1876	20	2
8	Manning, Charles Edward	New York	Sept. 14, 1876	17	6
9	Hall, Harry	Pennsylvania	Sept. 14, 1876	17	9
10	Allderice, William Hillary	Pennsylvania	Sept. 14, 1876	16	9
11	Young, Albert Osborn	New York	Sept. 14, 1876	19	2
12	Smith, Albert Edward	Wisconsin	Sept. 14, 1876	17	4
13	King, Charles Alfred	Maryland	Sept. 14, 1876	18	1
14	Kinkaid, Thomas Wright	Ohio	Sept. 14, 1876	16	6
15	Weaver, William Dixon	Pennsylvania	Sept. 14, 1876	19	1
16	Worthington, John Leeds	Maryland	Sept. 14, 1876	18	3
17	Smith, William Strother	Virginia	Sept. 15, 1875	18	0

ENGINEERS.

60—17 members.

Order of merit in—										Number of demerits.	Sea-service in practice-ships.		Order of general merit.
Ship-building.	Steam-engi- neering.		Heat and light.	Physical measurements.	Mechanics.	Naval architecture and method of least squares.	Naval architecture (elective).	Public law.	Spanish.		Months.	Days.	
	Mechanical drawing and fabrication.	Designing machinery and marine engines.											
4	1	1	1	2	2	2	2	1	2	95	7	25	*1
1	3	1	2	6	1	1	1	2	1	80	5	4	*2
7	7	8	3	1	7	4	4	5	8	153	5	4	3
3	8	7	4	2	6	3	5	10	17	54	7	19	4
6	6	3	5	8	4	5	3	11	5	45	5	4	5
10	2	4	10	13	8	5	5	14	8	111	7	25	6
12	10	11	8	1	5	14	9	3	3	94	5	4	7
4	5	5	11	15	9	18	.....	15	13	55	7	19	8
2	18	5	7	14	3	7	5	7	7	38	5	4	9
11	11	14	15	12	12	8	8	11	11	217	5	4	10
16	9	12	14	2	10	13	.....	13	12	55	5	4	11
9	4	8	13	9	15	9	.....	9	16	124	7	25	12
8	13	10	9	9	10	10	9	4	5	108	5	4	13
13	14	15	6	7	16	11	.....	8	18	103	5	4	14
18	11	13	12	17	14	16	.....	6	8	163	5	4	15
15	17	16	18	18	16	15	.....	18	4	51	5	4	16
17	15	16	17	15	18	17	.....	17	14	118	5	6	17

CADET.

First class—

Order of annual merit.	Name.	State.	Date of admission.	Agent date of admission.	
				Years.	Months.
20	Anderson, Martin Augustus	Wisconsin	Sept. 13, 1877	19	11
21	Arnold, Solon	Maryland.....	Sept. 14, 1876	22	2
10	Bankson, Lloyd	Pennsylvania.....	Sept. 13, 1877	19	9
9	Beach, Robert James	New York	Sept. 13, 1877	19	10
4	Belden, Charles Emery	Ohio	Sept. 14, 1876	18	6
18	Bush, Arthur Richmond	Massachusetts.....	Sept. 13, 1877	17	4
5	Byrne, James Edwin	Massachusetts.....	Sept. 14, 1876	19	5
8	Dowst, Frank Butland	Massachusetts.....	Sept. 13, 1877	18	3
22	Gartley, William Henry	Pennsylvania.....	Sept. 13, 1877	18	1
11	Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10
2	Kaemmerling, Gustave	Indiana	Sept. 13, 1877	19	3
	Lang, William	New York	Sept. 14, 1876	18	8
†	Mathews, Clarence Herbert	Ohio	Sept. 14, 1876	19	7
6	McAlpine, Kenneth	Virginia	Sept. 13, 1877	17	0
23	Moritz, Albert	New York	Sept. 13, 1877	17	2
14	Parsons, Isaac Brown	Michigan	Sept. 13, 1877	17	8
16	Perkins, Lyman Burnham	Connecticut	Sept. 13, 1877	18	7
7	Redgrave, De Witt Clinton	Maryland	Sept. 13, 1877	19	2
17	Sampson, Bias Clay	Illinois	Sept. 13, 1877	19	0
3	Shallenberger, Oliver Blackburn	Pennsylvania.....	Sept. 13, 1877	17	4
23	Smith, William Stuart	New York	Sept. 13, 1877	19	8
15	Stewart, Robert, jr.	Michigan	Sept. 13, 1877	19	5
9	Webster, William Townsend	New York	Sept. 13, 1877	20	1
12	White, William Wilmot	Pennsylvania.....	Sept. 13, 1877	17	11
1	Whitham, Jay Manuel	Illinois	Sept. 13, 1877	19	0

† Turned back from

RS.

rs.

a-engineering.		Order of merit in—					Number of demerits.	Sea-service in practice- ships.		Order of annual merit.
Fabrication of machinery.	Designing machinery.	Astronomy.	Heat and light.	Mechanics and applied mathematics.	Composition.	French.		Months.	Days.	
9	7	19	26	16	16	6	129	5	15	20
23	22	16	22	23	9	5	128	5	15	21
14	6	15	8	5	20	21	83	5	15	10
12	21	25	23	23	18	25	195	5	8	19
16	13	8	4	4	21	8	51	5	3	4
10	17	23	14	15	27	17	199	5	8	18
7	11	7	7	5	17	13	157	5	8	5
14	9	12	9	13	4	4	111	5	8	8
18	24	24	24	12	14	20	181	5	15	22
3	19	5	21	11	21	10	157	5	6	11
11	5	3	6	2	11	9	89	5	15	2
13	15	14	13	3	10	2	174	5	15	6
25	23	22	17	23	21	12	124	5	8	23
8	8	18	20	17	14	26	185	5	15	14
22	17	17	14	18	24	16	167	5	8	16
20	4	13	9	9	1	15	81	5	15	7
19	13	10	18	19	26	23	104	5	15	17
1	2	1	5	7	4	11	140	5	15	3
17	12	11	3	21	19	24	75	5	15	13
24	20	6	16	20	2	7	68	5	0	15
2	9	8	9	14	12	14	117	5	8	9
20	15	20	12	7	13	17	120	5	15	12
4	1	4	1	1	25	22	59	5	15	1

ating class.

Second

Order of annual merit.	Name.	State.	Date of admission.	Age at admission.
				Years.
21	Addicks, Walter Roberts	Pennsylvania	Oct. 1, 1878	17
7	Chambers, William Henry	Pennsylvania	Oct. 1, 1878	19
10	Clarke, Arthur Henry	Rhode Island	Oct. 1, 1878	18
23	Coley, Frederick Edward	New York	Oct. 1, 1878	16
9	Conant, Frank Henry	Massachusetts	Oct. 1, 1878	19
*3	Oreighton, William Henry Paul	Ohio	Oct. 1, 1878	19
12	Day, Willis Bunner	Ohio	Sept. 13, 1877	19
†	Eckel, Herman	Ohio	Sept. 14, 1876	20
*4	Ferguson, George Robert	Connecticut	Oct. 1, 1878	19
6	Fitts, James Henry	Virginia	Oct. 1, 1878	17
*2	Gatowood, Robert Woodland	Virginia	Oct. 1, 1878	16
20	Gladstone, Daniel Demarest	New Jersey	Sept. 13, 1877	18
13	Gsantner, Otto Charles	New Jersey	Oct. 1, 1878	19
11	Hawthorne, Harry Leroy	Kentucky	Oct. 1, 1878	19
17	Higgins, Robert Barnard	Maryland	Oct. 1, 1878	20
19	Howland, Charles Henry	Rhode Island	Oct. 1, 1878	17
16	Leonard, John Calvin	Ohio	Oct. 1, 1878	19
22	Leopold, Harry Girard	Ohio	Oct. 1, 1878	19
5	Miller, Peter	Kansas	Oct. 1, 1878	18
†	McAllister, Andrew	New York	Sept. 13, 1877	19
15	Pendleton, Joseph Henry	Pennsylvania	Oct. 1, 1878	18
8	Rommell, Charles Edward	Pennsylvania	Oct. 1, 1878	16
25	Shock, Thomas Alexander Wharton	Maryland	Oct. 1, 1878	18
	Simpson, Henry Lakin	Pennsylvania	Oct. 1, 1878	17
24	Taylor, Edward Kenyon	Massachusetts	Oct. 1, 1878	18
*1	Theiss, Emil	Wisconsin	Oct. 1, 1878	17
14	Willis, Clarence Calhoun	Mississippi	Oct. 1, 1878	19
18	Winchell, Ward Philo	Ohio	Oct. 1, 1878	19
26	Youchi, Sadanori	Japan	Sept. 21, 1878	19

Turned b

SEINEERS.

members.

Order of merit in—							Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
Trigonometry.	Analytical geometry.	Descriptive geometry.	Mechanical drawing and fabrication of machinery.	Physics and chemistry.	History and rhetoric.	French.		Months.	Days.	
22	22	17	13	22	15	24	243	5	1	21
7	8	4	5	5	3	9	81	5	1	7
8	11	12	26	11	6	7	158	5	1	10
23	24	26	19	24	25	20	242	5	1	23
12	16	11	6	7	11	8	108	5	1	9
3	5	6	11	9	2	4	75	5	1	*3
11	12	13	10	14	17	18	94	5	15	12
								5	1	+
4	6	2	1	4	13	14	37	5	1	*4
6	4	8	9	6	7	3	191	5	1	6
2	1	2	18	2	5	2	231	5	1	*2
20	19	19	20	21	18	20	223	5	1	20
15	13	14	3	11	20	5	202	5	1	13
10	15	9	12	15	9	22	136	5	1	11
18	16	10	8	16	19	15	136	5	1	17
13	25	24	20	20	14	13	153	5	1	19
17	9	16	27	16	12	19	110	5	1	16
23	18	22	15	13	23	25	233	5	1	22
5	3	7	14	3	3	6	194	5	1	5
								5	1	+
14	14	18	25	8	16	16	217	5	1	15
8	7	5	7	18	7	11	67	5	1	8
27	23	27	28	26	24	26	77	5	1	25
23			20				158	2	16	
18	26	23	23	22	22	23	90	5	1	24
1	2	1	4	1	1	1	174	5	1	*1
16	9	20	24	10	10	12	212	5	1	14
20	20	15	2	19	21	16	172	5	1	18
28	27	20	15	27	27		13	5	1	26

in first class.

3 N A R

...

RELATIVE STANDING.

CADET-ENGINEERS.

Third class—24 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit in—					Number of demerits.	Seas and practical ship.
				Years.	Months.	Mathematics.	Mechanical drawing.	English and history.	French.			
11	Aldrich, William Sleeper	N. J.	Oct. 1, 1879	16	6	9	1	20	16	23	1	
*2	Armistead, Samuel Wilson	Va...	Oct. 1, 1879	18	0	2	2	4	5	36	1	
6	Barnes, Charles Edwin	N. J.	Oct. 1, 1879	17	8	6	7	2	8	68	1	
*3	Baxter, William Joseph	Ohio.	Oct. 1, 1879	20	11	4	4	1	6	41	1	
15	Carswell, William Beggs	Del..	Oct. 1, 1879	18	10	16	16	12	17	98	1	
7	Darrah, William Francis	R. I..	Oct. 1, 1879	17	1	7	9	8	3	64	1	
24	Duvall, Marius, jr.	Md..	Oct. 1, 1879	20	3	24	17	23	24	253	1	
8	Dyson, Charles Wilson	Penn.	Oct. 1, 1879	17	9	8	13	10	13	64	1	
*5	Eaton, Charles Phillips	Wis.	Oct. 1, 1879	16	4	4	9	7	1	47	1	
19	Ellenger, Julius	Md..	Oct. 1, 1879	16	11	19	22	14	23	186	1	
*4	Ellicott, John Morris	Md..	Oct. 1, 1879	20	0	3	4	5	2	51	1	
13	Field, Harry Ashby	Va...	Oct. 1, 1879	17	2	12	18	15	14	11	1	
17	Gillis, Harry Alexander	Penn.	Oct. 1, 1879	17	9	21	18	17	10	117	1	
22	Glascock, Eustace Stranghn	Md..	Oct. 1, 1879	16	6	22	24	16	21	128	1	
14	Gross, Charles Jacob	Md..	Oct. 1, 1879	17	11	14	6	17	7	74	1	
12	Halstead, Alexander Seaman	Penn.	Oct. 1, 1879	17	9	11	14	11	9	82	1	
20	Herbert, William Cromwell	Penn.	Oct. 1, 1879	15	6	17	23	21	15	162	1	
23	Lawrance, William Hunter	Penn.	Oct. 1, 1879	20	11	23	12	22	21	82	1	
10	Littlehales, George Washington ..	Penn.	Oct. 1, 1879	18	11	13	15	5	11	41	1	
21	Palmer, James Edward	N. C.	Oct. 1, 1879	18	3	20	11	24	20	64	1	
18	Ryan, Philip Joseph	N. Y.	Oct. 1, 1879	19	11	17	21	19	19	193	1	
16	Webster, Charles Franklin	Penn.	Oct. 1, 1879	17	8	14	20	13	17	163	1	
*1	Woodruff, Charles Edward	Penn.	Oct. 1, 1879	18	11	1	3	3	4	65	1	
9	Zinnell, George Frederick	Penn.	Oct. 1, 1879	17	11	10	8	9	12	49	1	

CADET-ENGINEERS.

Fourth class—26 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
Christopher	Massachusetts	Oct. 1, 1880	19	0	2
Porter	Michigan	Oct. 1, 1880	18	7	9
ington Lee	Virginia	Oct. 1, 1880	16	8	19
d Owens	Maryland	Oct. 1, 1880	18	9	6
on	South Carolina	Oct. 1, 1880	18	7	24
d	Pennsylvania	Oct. 1, 1880	20	8	12
Marion	Alabama	Oct. 1, 1880	17	9	10
Almeron	New York	Oct. 1, 1880	19	3	3
as Hinman	Pennsylvania	Oct. 1, 1880	16	4	8
insey	Ohio	Oct. 1, 1880	19	6	26
ur Lewia	Ohio	Oct. 1, 1880	19	9	20
er Oliphant	New Jersey	Oct. 1, 1880	20	10	18
W	Virginia	Oct. 1, 1880	19	1	22
re Otis	Maryland	Oct. 1, 1880	18	5	7
ster Mahlon	Pennsylvania	Oct. 1, 1880	18	9	17
eric James	Connecticut	Oct. 1, 1880	18	0	13
y Kent	Georgia	Oct. 1, 1880	20	5	23
bert Clifton	Ohio	Oct. 1, 1880	18	10	16
unter	Delaware	Oct. 1, 1880	20	0	5
enry Earl	Rhode Island	Oct. 1, 1880	19	6	4
nas Putnam	Maryland	Oct. 1, 1879	19	6	7
hornton Russell	Pennsylvania	Oct. 1, 1880	20	1	11
urton	Kansas	Oct. 1, 1880	19	2	15
Lawrence Alexander	Virginia	Oct. 1, 1880	18	0	1
rt Lincoln	Pennsylvania	Oct. 1, 1880	19	4	14
James Houston	Indiana	Oct. 1, 1880	19	1	21

SUMMARY.

November 1, 1880.

CADET-MIDSHIPMEN.

.....	77 members.
.....	40 members.
.....	53 members.
.....	51 members.
	221

CADET-ENGINEERS.

.....	25 members.
.....	29 members.
.....	25 members.
.....	26 members.
	105
.....	328

DEATHS, RESIGNATIONS, AND DISMISSALS

November 16, 1879 to November 1, 1880.

DIED.

Cadet-Midshipman John M. Moore.....Boonville, Ind., November
Cadet-Engineer Llewellyn F. Whittle....Naval Hospital, Philadelphia, July

DISMISSED.

Cadet-Midshipman Smith Salisbury.....Jan.

RESIGNED.

Cadet-Midshipman William Y. Slack.....Dec.
Cadet-Midshipman Sidney H. Dent Mar.
Cadet-Midshipman John K. Morris.....Mar.
Cadet-Midshipman John R. Miner Apri
Cadet-Midshipman Robert B. Blake Apri
Cadet-Midshipman Samuel E. Belford.....April
Cadet-Midshipman Louis M. Wentworth July
Cadet-Midshipman Oliver D. Norton Sept.
Cadet-Midshipman Harlen Pefley Oct.

DROPPED.

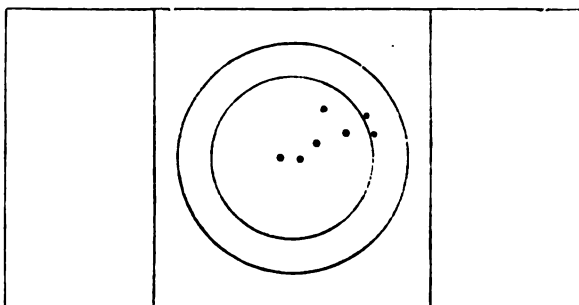
Cadet-Midshipman William P. Hoke July
Cadet-Midshipman James A. Lamkin July
Cadet-Midshipman Arlington L. Lovenskiold.....July
Cadet-Midshipman John A. McCook July
Cadet-Midshipman Harry Rankin July

WITHDRAWN.

Japanese Student Yenoske Ebouye.....Aug.

ANNUAL RIFLE-MATCH

CLASS OF 1880.



Target showing score of W. H. Emerson.

TERMS OF THE MATCH.

Position, that of a skirmisher lying down
 Number of shots, 7.
 Possible score, 35.
 Rifle, that adopted by the National Rifle Association of 1875.
 Distance, 400 yards.
 Magazine, Hotchkiss magazine.

Name.	1.	2.	3.	4.	5.	6.	7.	Total.
Emerson	5	4	5	5	5	4	5	33
Bernadou	4	4	5	5	5	5	5	33
Dresel	4	4	5	4	5	4	5	31
Tatters	5	5	3	4	4	4	5	30
Vall	4	4	5	5	4	4	4	30
Total								157

Score of class 21.5

SUMMER CRUISE, 1880.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION.

Commander E. M. SHEPARD, *Commanding.*
Lieutenant J. C. SOLEY, *Executive Officer.*
Lieutenant C. BELKNAP, *Navigator.*
Lieutenant C. A. STONE, *Watch Officer.*
Lieutenant R. P. RODGERS, *Instructor in Navigation*
Lieutenant G. W. TYLER, *Watch Officer.*
Master C. P. REES, *Watch Officer.*
Master C. H. LYMAN, *Watch Officer.*
Master C. R. MILES, *Watch Officer.*
Passed Assistant Surgeon C. U. GRAVATT.
Passed Assistant Surgeon C. T. HIBBETT.
Paymaster A. BURTIS.
Chaplain J. S. WALLACE.

CADET-MIDSHIPMEN.

First class (76).

Andrews, H. B.	Doyen, C. A.	Kimball, J. A.	Robinson, W. M.
Ballentine, H. L.	Dresser, J. W.	Lauchheimer, C. H.	Rodgers, G. G.
Barnett, G.	Eldredge, H.	Linnard, J. H.	Russell, W. W.
Blow, G. P.	Emmett, W. Le R.	McCrea, A. S.	Schock, J. L.
Bonfile, T. L.	Enouye, Y.	McJunkin, I.	Serata, T.
Bryan, S.	Flournoy, W. F.	McKee, L. P.	Smies, F. W.
Buck, G. M.	Ford, W. G.	Mahoney, J. E.	Stayton, W. H.
Bunts, F. E.	ForsheW, R. P.	Matthews, T. H.	Stewart, C. W.
Capehart, E. E.	George, C. P.	Moses, F. J.	Sutton, F. E.
Carroll, E.	Gresham, W. A.	Oliphant, A. C.	Uriu, S.
Clark, G.	Haines, H. C.	Orlopp, M. A.	Vance, Z. B.
Cockle, R. R.	Hains, R. P.	Parker, F.	Weeks, J. W.
Cohen, H. R.	Harmon, E. M.	Parsons, A. C.	Weller, O. E.
Colwell, J. H.	Harrison, E. H.	Perkins, C. M.	White, H. K.
Craven, M.	Hasson, A. R.	Perry, G. E.	Wilkes, G.
Craig, B. H.	Hoogewerf, J. A.	Pierce, B. G.	Williamson, S. H.
Crenshaw, J. D.	Hunicke, F. H.	Printup, D. L.	Wilson, H. B.
Dashiell, R. B.	Karmany, L.	Rees, J. L.	Woodward, J. J.
Donnelly, M. J.	Kase, S. M.	Rider, F. C.	Wright, S. H.

Third class (48).

P.	Frazier, R. T.	Lennon, W. E.	Smith, T. B.
r, R. C.	George, H.	Lerch, R. E.	Solomon, E. E.
I. H.	Gignilliat, T. H.	McKean, J. S.	Stout, G. C.
J. H.	Gray, W. T.	Megrath, W. A.	Sweeting, C. W.
W. E.	Greene, S. D., jr.	Mitchell, S. Z.	Street, G. W.
T.	Hepp, C. F.	O'Leary, T. S.	Temple, E. G.
; J. F.	Jackson, J. A.	Parker, F. A.	Thurston, B. E.
N. L.	Jackson, J. B.	Petit, H. C.	Toney, T. V.
. R.	Keith, A. G.	Philbin, P. H.	Weeks, E. B.
. J. G.	Keifer, E. E.	Plunket, C. P.	Wilson, W. J.
e, E. W.	Ledbetter, W. H.	Reynolds, C. R.	Witherspoon, T. A.
.	Legare, A. B.	Ricketts, W. W.	Woods, R. H.

Installation sailed from Annapolis June 18, and arrived at the navy-yard, June 25; from thence she proceeded on her practice-cruise, touching at Newport, Nahant, and New London. She sailed from New London August 20, and off the Naval Academy August 28.

UNITED STATES PRACTICE-SHIP DALE.

Lieutenant-Commander E. WHITE, *Commanding*.

Lieutenant E. DE F. HEALD, *Executive Officer*.

Lieutenant J. V. B. BLEECKER.

Lieutenant A. B. SPEYERS.

Master L. A. FRAILEY.

Assistant Surgeon G. P. LUMSDEN.

CADET-MIDSHIPMEN.

Second class (42).

E. A.	Fowler, H.	King, W. N.	Patterson, S. A. W.
T.	Grambs, W. J.	Lodeman, F. F. F.	Poyer, J. M.
L. S.	Gwyn, L. S.	McGiffin, P. N.	Prince, T. C.
J. J.	Horst, H. A.	McWhorter, J. G.	Savage, L. R.
J. J.	Howard, W. L.	Martin, C.	Semple, L.
G.	Hubbard, N. M.	Morgan, D.	Smythe, J. W.
J. J.	Jayne, J. L.	Morris, W. E.	Stahle, F. H.
N. B.	Johnson, M.	Nixon, L.	Stnphen, E. W.
H.	Kenkel, H. H.	Norton, O. D.	Whittelsey, W. B.
R. M.	Kent, G. E.	Paine, W. T.	Wood, S. S.
W. B.	Key, A. L.		

Fourth class (21).

J. C.	Hoggatt, W.	McIntire, A. E.	Sargent, T. H.
A. N.	Jastremski, L. H.	McNulta, H.	Shoemaker, W. R.
G.	Johnson, W.	Maxey, J. W.	Sparling, T. H.
W. G.	Lamison, J. G.	Moseley, N. S.	Stevens, R. R.
V. W.	McCord, H. H.	Raichle, F. G.	Williams, W. P.
C. W.			

Third class (1).

Phythian, C. T.

The Dale sailed from Annapolis June 19, and cruised in Chesapeake Bay as far as Hampton Roads, and in the York, Patuxent, and Potomac Rivers, returning to Naval Academy August 6.

UNITED STATES PRACTICE-STEAMER DESPATCH.

Lieutenant-Commander F. A. COOK, *Commanding.*Lieutenant W. H. PARKER, *Executive Officer.*Lieutenant R. RUSH, *Navigator.*

Surgeon M. L. RUTH.

Assistant Paymaster H. R. SMITH.

Passed Assistant Engineer J. C. KAUFER.

Assistant Engineer, A. M. MATTICE.

Cadet-Engineer A. W. STAHL.

Cadet-Engineer A. T. WOODS.

Cadet-Engineer A. E. SMITH.

CADET-ENGINEERS.

First Class (23).

Anderson, M. A.	Byrne, J. E.	Parsons, I. B.	Stewart, R., jr.
Arnold, S.	Dowst, F. B.	Perkins, L. B.	Webster, W. T.
Bankson, L.	Gartley, W. H.	Redgrave, D. W. C.	White, W. W.
Beach, R. J.	Kaemmerling, G.	Sampson, B. C.	Whitham, J. M.
Belden, C. E.	McAlpine, K.	Shallenberger, O. B.	Whittle, L. F.
Bush, A. R.	Moritz, A.	Smith, W. S.	

CADET-ENGINEERS.

Second Class (26).

Addicks, W. R.	Ferguson, G. R.	Howland, C. H.	Rommel, C. E.
Chambers, W. H.	Fitts, J. H.	Leonard, J. C.	Shock, T. A. W.
Clarke, A. H.	Gatewood, R. W.	Leopold, H. G.	Taylor, E. K.
Coley, F. E.	Gladstone, D. D.	McAllister, A.	Theiss, E.
Conant, F. H.	Gsantner, O. C.	Miller, P.	Willis, C. E.
Creighton, W. H. P.	Hawthorne, H. L.	Pendleton, J. H.	Winchell, W. F.
Day, W. B.	Higgins, R. B.		

UNITED STATES PRACTICE-STEAMER STANDISH.

Lieutenant-Commander C. J. TRAIN, *Commanding*.
 Lieutenant F. M. WISE, *Executive Officer*.
 Passed-Assistant Engineer G. H. KEARNY.
 Assistant Engineer A. V. ZANE.
 Cadet-Engineer W. S. SAMPLE.
 Cadet-Engineer C. E. MANNING.

CADET-ENGINEERS.

Third Class (25).

ich, W. S.	Dyson, C. W.	Glasscock, E. H.	Palmer, J. E.
instead, S. W.	Eaton, C. P.	Gross, C. J.	Quinby, J. H.
ies, C. E.	Ellinger, J.	Halstead, A. S.	Ryan, P. J.
ter, W. J.	Ellicott, J. M.	Herbert, C.	Webster, C. F.
well, W. B.	Fields, H. A.	Lawrance, W. H.	Woodruff, C. E.
rah, W. F.	Gillis, H. A.	Littlehales, G. W.	Zinnell, G. F.
all, M., jr.			

CADET-ENGINEER.

Fourth Class (1).

Pattison, T. P.

the practice-steamer Despatch, accompanied by the Standish for a portion of the
 se, steamed from the Naval Academy June 17, and touched at Washington, D. C.,
 folk, Va., New Castle, Del., Edgemoor, Del., Chester, Pa., Philadelphia, Pa., New
 r, West Point, N. Y., Cold Spring, N. Y., Newburg, N. Y., Newport, R. I., Bristol,
 ., Rocky Point, R. I., Boston, Mass., visiting the different navy-yards, work and
 hine shops, iron foundries, etc., at the above-named places; and returning, an
 ed off the Naval Academy August 29.

TABLE OF COEFFICIENTS.

Department.	Subject.	Cadet-Midshipmen.					Cadet-Engine			
		Fourth class.	Third class.	Second class.	First class.	Graduating maxima for required studies.	Fourth class.	Third class.	Second class.	First class.
Seamanship.	Seamanship	2	3	10	16					
	Naval Tactics			2						
	Ship-building				4	148				
Ordnance and Gun- nery.	Ordnance Instructions and In- fantry Tactics			5						
	Ordnance and Armor				14	76				
	Algebra and Geometry	8					9			
Mathematics.	Trigonometry		8						6	
	Analytical Geometry		7						7	
	Descriptive Geometry		3			104			5	
Steam-Engineering.	Mechanical Drawing						3	5	5	14
	Fabrication of Machinery									
	Designing Machinery								8	2
	Marine Engines				13	52				
Astronomy, Naviga- tion, and Surveying.	General Astronomy			6						4
	Theoretical Navigation				8					
	Practical Navigation									
	Surveying and Compass Devia- tions					92				
Physics and Chemis- try.	Physics and Chemistry	4	5					4	5	
	Light and Heat		5						5	
	Electricity				6	80				
	Physical Measurements									
Mechanics and Ap- plied Mathematics.	Mechanics and Calculus			14					14	
	Applied Mechanics									11
	Naval Architecture and Method of Least Squares									
	Elective Course in Naval Archi- tecture				12	56				11
English Studies, His- tory, and Law.	English and History	5					5			
	History and Rhetoric		6					6		
	English and History			5					5	
	Public Law				3	76				
Modern Languages.	French	2	5	5	3	60	2	5	5	3
Drawing.	Drawing	2	2			16				
Maximum for each year, exclusive of electives		76	152	228	304	760	76	152	228	304
Deduction for each demerit		.004	.007	.013	.030		.004	.007	.013	.030

MERIT-ROLLS FOR 1879-80.

Merit-rolls, made out annually for each class, show the proficiency of the cadets in each branch of study. The numbers given in the preceding table, showing the relative weight of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the cadet for the year.

In the case of cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 2.50.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

"Cadets who attain 85 per cent. of the multiple in any year shall be distinguished by a star affixed to their names on the merit-rolls."—(Regulations U. S. Naval Academy, § 150.)

Cadets whose names are marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

(a) denotes absence from examination.

MIDSHIPMEN.

Class of 1878 (36 members). Final examination, June, 1880.

Order of merit.	Name.	Seamanship.		Gunnery.		Naval tactics.		Steam-engineering.		Navigation and surveying.		French.		Aptitude.		Aggregate for examination.		General aggregate for four years.		Final aggregate.	
		48	48	48	48	12	48	48	24	12	240	760	1,000								
1	Maxima.....																				
2	John H. Fillmore.....	42.36	44.76	10.74	43.20	42.36	19.92	11.40	214.74	695.42	910.16										
3	Thomas S. Rodgers.....	42.60	45.12	11.88	44.40	47.40	23.10	11.40	225.90	674.96	900.86										
4	John G. Quinby.....	40.68	41.04	10.78	46.20	46.80	17.82	10.80	214.12	666.53	880.65										
5	Charles S. McClain.....	40.32	41.04	12.00	42.00	42.00	19.56	11.40	208.92	654.85	863.77										
6	James H. Glennon.....	42.48	39.72	11.76	43.80	40.80	20.82	10.80	210.18	647.81	857.99										
7	Harry S. Knapp.....	37.80	41.88	11.16	44.40	40.20	20.10	11.40	206.94	636.27	837.21										
8	Frank J. Sprague.....	25.08	40.92	11.94	43.80	45.00	17.40	10.80	194.94	628.81	823.75										
9	William L. Rodgers.....	38.04	43.32	11.85	43.20	45.00	19.80	10.80	212.01	609.63	821.64										
10	Roy C. Smith.....	37.68	43.68	11.64	46.80	34.56	18.00	11.40	203.76	613.59	817.35										
11	Albert N. Wood.....	41.28	40.20	11.97	36.60	35.40	16.50	10.20	192.15	609.14	801.29										
12	Edward Lloyd, Jr.....	45.48	40.92	12.00	40.80	36.36	17.52	10.80	203.88	596.92	800.80										
13	Harry McL. P. Huse.....	36.72	36.00	10.86	37.20	36.96	23.40	11.70	192.84	602.87	793.71										
14	Richard M. Hughes.....	36.60	38.28	11.58	38.40	35.40	22.50	10.80	193.56	593.38	788.94										
15	Charles N. Atwater.....	36.60	39.48	11.79	38.40	33.60	20.22	10.20	190.29	597.87	783.16										
16	John H. L. Holcombe.....	28.88	38.28	11.13	37.20	31.80	20.70	10.80	188.79	593.43	784.22										
17	George F. Ormsby.....	28.64	41.88	10.68	37.20	33.36	16.80	8.25	183.81	590.30	783.11										
18	Robert E. Wright.....	39.36	39.60	6.00	39.60	39.60	18.00	10.50	195.36	583.61	779.00										

	42. 00	35. 10	10. 50	45. 20	31. 20	11. 80	11. 80	174. 09	554. 08	101. 10
28 John H. Snipey.....	34. 56	36. 72	10. 41	35. 40	28. 20	19. 20	9. 60	174. 09	554. 08	728. 17
29 Thomas W. Ryan.....	38. 60	35. 88	11. 01	37. 20	34. 80	17. 82	10. 80	174. 11	541. 33	725. 44
30 John E. Craven.....	36. 24	32. 52	10. 92	32. 40	30. 96	16. 92	10. 80	170. 76	541. 53	719. 29
31 George Sparhawk.....	36. 12	36. 36	11. 58	39. 60	33. 36	18. 10	10. 20	183. 32	522. 32	705. 64
32 James H. Hetherington.....	31. 56	38. 40	10. 74	34. 20	31. 32	16. 50	11. 10	173. 82	530. 37	704. 19
33 John J. Knapp.....	40. 32	33. 84	10. 20	34. 80	30. 00	15. 60	10. 80	175. 56	520. 60	606. 25
34 Baine C. Dent.....	36. 84	32. 76	11. 73	32. 40	26. 40	18. 00	9. 60	167. 73	514. 73	682. 46
Wilson L. Todd.....								(a)	528. 79	.....
Horatio H. Hooke.....								(a)	523. 40	.....
Valentine S. Nelson (class of 1877).....	38. 16	39. 24	11. 70	41. 40	39. 36	19. 20	10. 20	196. 26	559. 08	753. 34

24	Louis S. Van Duzer.....	52.64	12.64	42.98	41.60	27.45	24.00	19.08	.....	10.05	8.28	2.04	236.08	165.82	110.13	50.57
25	Joseph H. Rohrlacher	49.28	11.56	42.98	36.40	24.93	22.32	18.84	.....	10.11	9.12	2.82	222.72	171.46	112.09	56.48
26	Joseph Reale	55.68	11.40	39.06	33.49	26.55	23.24	17.88	.....	10.02	8.88	4.29	222.91	167.74	111.37	59.29
27	Edward Simpson, jr	55.20	12.08	46.48	37.83	27.09	23.12	17.46	.....	9.09	8.49	2.68	224.86	165.93	104.43	55.71
28	James C. Drake	48.32	12.08	41.72	37.18	27.81	24.24	18.46	.....	8.67	8.82	4.14	222.76	163.10	110.66	63.45
29	Joseph M. Dickson	48.56	11.16	43.68	38.87	26.73	22.96	18.84	.....	10.86	9.00	1.53	227.13	163.02	111.90	54.46
30	George L. Dillman	49.92	10.32	41.30	35.23	23.31	22.56	15.60	.....	8.55	8.85	4.65	210.96	171.59	118.71	55.07
31	Frank W. Bowdon	53.92	12.04	42.84	34.32	24.75	21.84	17.16	.....	10.65	9.27	1.71	225.06	163.04	107.62	58.57
32	Augustus N. Mayer	49.44	11.72	43.40	36.27	26.37	23.20	17.52	.....	9.48	8.55	3.81	222.14	165.09	109.12	57.55
33	William S. Sims	51.84	12.88	45.22	45.24	26.91	23.28	19.62	.....	9.75	8.49	4.38	228.85	158.94	105.77	48.99
34	Wilson W. Buchanan	53.44	12.32	42.28	37.05	25.11	23.76	17.52	.....	8.94	8.82	0.83	228.31	176.40	98.68	48.48
35	Edwards F. Leiper	51.36	12.64	43.54	38.74	25.38	22.80	17.22	.....	9.60	8.46	2.22	227.61	159.73	104.24	50.62
36	Fred R. Brinard	51.20	11.16	44.24	38.48	24.48	24.64	18.00	.....	8.37	8.37	3.39	225.55	164.26	107.20	53.31
37	William E. Safford	47.52	11.84	40.60	37.18	24.66	21.52	17.76	.....	9.21	11.46	2.94	218.81	165.11	109.68	55.84
38	Manning K. Eyre	50.24	11.52	42.14	36.79	25.20	23.76	17.52	.....	9.09	9.36	4.47	221.15	164.81	106.78	56.38
39	Miles C. Gorgas	50.08	10.76	30.48	36.01	24.84	22.08	16.68	.....	8.31	10.26	3.15	215.35	172.80	104.86	54.04
40	Richard H. Scott	51.04	12.04	42.56	39.13	26.01	22.64	18.84	.....	9.72	8.82	3.81	228.99	158.87	106.22	53.83
41	Francis R. Wall	49.12	10.88	42.00	35.88	25.02	23.44	17.22	.....	9.90	9.27	4.08	218.65	161.34	109.42	54.73
42	Henry M. Finley	49.76	11.12	30.48	37.96	27.45	24.32	16.38	.....	10.08	8.76	4.77	220.54	161.03	101.81	57.04
43	Horatio L. Fillebrown	46.72	10.24	39.34	36.01	23.94	21.12	15.90	.....	8.40	8.40	3.18	206.89	157.53	105.42	62.25
44	Thomas Worthington	55.68	12.60	42.42	33.93	23.40	21.52	16.02	.....	9.54	8.76	2.91	220.96	158.11	101.18	49.16
45	William J. Maxwell	52.96	12.40	42.14	32.89	23.04	20.90	15.72	.....	9.27	8.13	2.64	214.71	153.37	107.49	48.73
46	Fitz-Aubert Huntoon	49.12	11.56	41.02	35.88	25.56	21.76	16.80	.....	8.73	8.25	4.17	214.51	154.09	103.06	54.04
47	Franklin Swift	50.40	11.48	40.32	36.01	24.66	22.24	16.68	.....	9.27	8.10	3.45	215.71	155.89	98.76	53.31
48	Charles H. Hill	55.20	11.56	39.48	36.66	22.66	20.88	16.02	.....	10.38	8.31	4.65	216.52	164.03	91.25	50.43
49	George K. French	46.88	10.90	39.20	34.19	21.78	21.52	17.94	.....	9.48	8.34	3.83	206.20	153.74	111.72	49.47
50	Henry B. Ashmore	49.92	11.72	37.80	35.62	24.93	21.36	16.86	.....	8.73	9.03	4.63	211.35	158.54	99.13	50.13
51	James Gray	48.00	10.52	43.12	34.56	24.21	21.52	15.84	.....	10.53	7.98	3.81	212.49	153.13	96.65	55.37
52	Theodore G. Dewey	46.40	10.72	40.32	34.06	23.41	21.68	16.02	.....	8.76	7.83	2.82	206.29	154.46	96.27	56.93
53	Amrose Cramer	48.32	10.92	38.78	33.54	22.95	21.12	16.02	.....	8.94	7.95	3.54	205.56	154.46	103.60	52.14
54	John F. Luby	52.16	12.00	41.86	34.84	23.76	21.60	15.90	.....	9.48	8.43	4.32	215.71	154.37	96.03	46.35
55	Walter G. Richardson	44.64	10.16	39.48	35.23	22.14	21.60	16.20	.....	9.57	8.64	4.20	203.46	157.65	96.18	49.90
56	Lewis J. Clark	47.04	11.00	38.08	33.80	24.12	23.28	18.12	.....	8.76	7.93	4.59	207.56	153.38	103.20	45.87

CADET-MIDSHIPMEN—Continued.
Merit-roll of first class (62 members), annual examination, June, 1880, and general merit-roll for four years.

Order of general merit.	Name.	Seamanship.	Ship-building.	Ordnance.	Marine engines.	Theoretical navigation.	Practical navigation.	Heat.	Naval architecture (elective).	Public law.	Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
	Maxima.	64	16	56	52	36	32	24	3.60	12	12		304	325	152	76	760
57	Edwin W. Nash.....	46.88	11.04	39.66	35.75	25.50	22.00	16.62	.....	9.06	8.28	4.98	269.27	152.51	96.32	48.63	500.73
58	James S. Brown.....	48.48	10.40	37.38	33.41	24.63	20.48	15.78	.....	8.52	8.01	4.59	261.80	140.87	97.85	52.52	502.14
59	Oliver H. P. Belmont.....	48.32	10.24	35.56	32.76	20.97	20.00	15.30	.....	7.80	8.40	4.32	195.03	156.31	98.98	51.32	501.64
60	Edward Brinley.....	44.32	10.60	41.02	34.45	23.31	21.68	15.24	.....	8.85	8.40	1.56	206.40	148.49	96.76	48.74	500.39
61	Hugh Rodman.....	46.40	11.12	38.78	35.23	22.23	21.36	16.02	.....	8.58	7.08	3.51	204.19	147.46	95.53	51.86	499.04
†	Howard H. Ballitt.....	42.72	10.36	38.60	31.20	22.23	20.24	15.30	.....	8.13	8.16	2.94	193.90	147.41	95.12	53.50	488.93

MERIT-ROLL OF SECOND CLASS (78 MEMBERS), ANNUAL EXAMINATION, JUNE, 1880.

Order of annual merit.	Name.	Seamanship.				Naval tactics.		Ordnance instructions and infantry tactics.		Astronomy.		Heat and light.		Mechanics and applied mathematics.		Composition.		French.		Conduct.		Aggregate.
		40	8	20	24	40	56	20	24	40	56	20	24	40	56	20	24	40	56	20	24	228
	Maxima	34.40	7.62	18.05	21.96	39.40	58.06	16.90	21.96	39.40	58.06	16.90	21.96	39.40	58.06	16.90	21.96	39.40	58.06	16.90	21.96	211.40
*1	J. L. Schook	35.50	7.70	17.10	21.18	38.40	54.04	17.20	21.18	38.40	54.04	17.20	21.18	38.40	54.04	17.20	21.18	38.40	54.04	17.20	21.18	205.47
*2	J. J. Woodward	33.30	7.22	16.25	21.42	37.90	54.88	16.70	21.42	37.90	54.88	16.70	21.42	37.90	54.88	16.70	21.42	37.90	54.88	16.70	21.42	203.80
*3	J. H. Linnard	33.40	7.52	17.10	21.06	38.70	51.80	17.20	21.06	38.70	51.80	17.20	21.06	38.70	51.80	17.20	21.06	38.70	51.80	17.20	21.06	201.32
*4	J. A. Hoogewerff	33.00	6.88	16.85	20.46	37.50	53.00	17.30	20.46	37.50	53.00	17.30	20.46	37.50	53.00	17.30	20.46	37.50	53.00	17.30	20.46	198.72
*5	F. C. Rider	33.00	7.34	17.25	21.00	38.80	52.78	17.80	21.00	38.80	52.78	17.80	21.00	38.80	52.78	17.80	21.00	38.80	52.78	17.80	21.00	197.38
*6	J. L. Rees	34.70	6.22	16.35	21.72	38.20	44.80	17.40	21.72	38.20	44.80	17.40	21.72	38.20	44.80	17.40	21.72	38.20	44.80	17.40	21.72	196.50
*7	L. Karmany	28.60	7.30	16.05	20.82	38.40	49.84	16.80	20.82	38.40	49.84	16.80	20.82	38.40	49.84	16.80	20.82	38.40	49.84	16.80	20.82	195.27
*8	F. E. Sutton	36.00	7.64	18.40	19.20	32.40	45.64	17.30	19.20	32.40	45.64	17.30	19.20	32.40	45.64	17.30	19.20	32.40	45.64	17.30	19.20	194.61
*9	R. B. Dashiell	32.90	7.58	16.20	20.40	35.50	49.00	16.40	20.40	35.50	49.00	16.40	20.40	35.50	49.00	16.40	20.40	35.50	49.00	16.40	20.40	192.79
10	H. K. White	32.90	6.80	16.15	19.86	34.90	45.50	14.95	19.86	34.90	45.50	14.95	19.86	34.90	45.50	14.95	19.86	34.90	45.50	14.95	19.86	187.33
11	E. E. Capehart	31.20	6.86	16.30	20.40	31.60	49.00	16.45	20.40	31.60	49.00	16.45	20.40	31.60	49.00	16.45	20.40	31.60	49.00	16.45	20.40	185.52
12	E. Carroll	30.60	5.72	15.65	18.48	35.80	40.70	14.75	18.48	35.80	40.70	14.75	18.48	35.80	40.70	14.75	18.48	35.80	40.70	14.75	18.48	182.70
13	W. H. Stayton	34.40	7.38	15.90	18.24	34.00	41.58	15.85	18.24	34.00	41.58	15.85	18.24	34.00	41.58	15.85	18.24	34.00	41.58	15.85	18.24	182.11
14	F. E. Banta	35.50	7.24	17.55	18.66	36.10	39.48	16.05	18.66	36.10	39.48	16.05	18.66	36.10	39.48	16.05	18.66	36.10	39.48	16.05	18.66	180.56
15	H. Eldredge	32.80	5.94	14.00	19.68	30.10	50.40	14.70	19.68	30.10	50.40	14.70	19.68	30.10	50.40	14.70	19.68	30.10	50.40	14.70	19.68	180.33
16	T. Serata	31.70	5.78	16.45	18.12	35.30	40.88	15.20	18.12	35.30	40.88	15.20	18.12	35.30	40.88	15.20	18.12	35.30	40.88	15.20	18.12	178.63
17	C. H. Lauchheimer	31.60	6.50	16.40	19.56	34.20	42.00	15.45	19.56	34.20	42.00	15.45	19.56	34.20	42.00	15.45	19.56	34.20	42.00	15.45	19.56	177.83
18	A. R. Hason	31.40	6.82	16.75	18.78	31.10	39.48	16.80	18.78	31.10	39.48	16.80	18.78	31.10	39.48	16.80	18.78	31.10	39.48	16.80	18.78	176.23
19	R. P. Forshaw	32.40	6.56	16.85	18.96	29.70	41.30	15.95	18.96	29.70	41.30	15.95	18.96	29.70	41.30	15.95	18.96	29.70	41.30	15.95	18.96	176.16
20	C. A. Doyen	36.20	6.70	15.35	19.14	29.30	40.46	15.40	19.14	29.30	40.46	15.40	19.14	29.30	40.46	15.40	19.14	29.30	40.46	15.40	19.14	175.15
21	G. Wilkes	32.20	7.34	15.35	18.54	31.70	38.22	15.30	18.54	31.70	38.22	15.30	18.54	31.70	38.22	15.30	18.54	31.70	38.22	15.30	18.54	174.36
22	H. B. Andrews																					1.00

CADET-MIDSHIPMEN.
Merit-roll of second class (78 members), annual examination, June, 1880—Continued.

Order of annual merit.	Name.	Seamanship.		Naval tactics.		Ordnance instruction and infantry tactics.		Astronomy.		Heat and light.		Mechanics and applied mathematics.		Composition.		French.		Conduct.		Aggregate.
		40	2	20	21	40	36	20	21	40	36	20	21	20	20	20	20	20	20	228
	Maxima																			
23	H. B. Wilson	31.40	7.10	15.20	16.74	30.50	40.34	15.25	16.74	30.50	40.34	15.25	16.74	13.75	13.75	1.96	174.32			
24	F. H. Hunick	31.00	6.38	16.45	16.44	27.60	42.56	16.70	16.44	27.60	42.56	16.70	16.44	17.40	17.40	0.88	173.05			
25	E. H. Harrison	32.30	7.52	15.20	16.50	32.10	42.56	14.80	16.50	32.10	42.56	14.80	16.50	13.40	13.40	1.21	173.27			
26	F. J. Moses	30.20	6.82	15.10	18.06	32.70	44.84	13.50	18.06	32.70	44.84	13.50	18.06	13.90	13.90	2.16	173.06			
27	G. P. Blow	33.40	6.94	17.35	17.76	28.10	39.90	16.10	17.76	28.10	39.90	16.10	17.76	13.70	13.70	2.05	171.10			
28	G. Barnett	32.20	6.74	15.00	18.72	30.90	38.22	15.30	18.72	30.90	38.22	15.30	18.72	13.65	13.65	0.40	171.03			
29	R. G. Pierce	30.70	6.90	15.90	19.38	31.30	38.50	16.15	19.38	31.30	38.50	16.15	19.38	13.95	13.95	2.27	170.51			
30	J. E. Mahoney	32.10	6.96	16.50	16.02	29.20	37.24	16.25	16.02	29.20	37.24	16.25	16.02	16.30	16.30	0.90	169.61			
31	C. M. Perkins	30.40	6.66	16.70	18.72	26.70	41.16	15.10	18.72	26.70	41.16	15.10	18.72	15.10	15.10	1.29	169.25			
32	F. W. Smith	30.50	6.92	15.50	17.94	30.30	38.92	15.85	17.94	30.30	38.92	15.85	17.94	14.70	14.70	1.60	168.97			
33	S. Utin	32.50	7.02	14.45	16.71	27.80	38.50	17.05	16.71	27.80	38.50	17.05	16.71	14.70	14.70	0.61	168.15			
34	H. C. Haines	31.50	6.08	16.65	16.92	27.90	39.76	16.20	16.92	27.90	39.76	16.20	16.92	14.50	14.50	1.73	167.78			
35	H. L. Ballentine	30.00	6.62	11.65	16.92	30.60	38.50	16.40	16.92	30.60	38.50	16.40	16.92	11.75	11.75	1.70	167.61			
36	J. A. Kimball	32.30	6.28	15.35	18.36	29.00	39.92	14.95	18.36	29.00	39.92	14.95	18.36	14.55	14.55	2.34	167.37			
37	W. F. Fotheroy	25.80	6.30	15.10	18.00	31.30	38.50	15.10	18.00	31.30	38.50	15.10	18.00	17.60	17.60	1.59	166.41			
38	J. W. Wicks	30.60	6.56	16.30	16.14	30.70	38.22	14.80	16.14	30.70	38.22	14.80	16.14	17.60	17.60	0.65	166.27			

MERIT-ROLLS, JUNE, 1880.

51

	18.20	17.50	26.00	28.75	18.05	14.50	2.45	102.01
<i>C. W. Stewart</i>	28.30	6.64	16.44	28.20	14.95	15.55	2.51	161.80
48 W. L. Emmet.....	30.20	6.64	17.58	25.70	15.30	12.80	2.44	161.50
49 D. L. Printup.....	29.30	5.88	17.34	27.70	14.60	14.40	1.46	160.81
50 S. M. Kase.....	27.10	5.28	18.06	27.20	15.70	15.10	0.55	160.41
51 R. R. Cockle.....	32.10	5.22	16.90	28.50	16.20	13.85	2.40	160.37
52 R. P. Hains.....	29.00	5.86	16.55	27.80	14.95	13.90	1.91	160.17
53 S. Bryan.....	28.30	6.82	16.44	28.40	14.55	14.35	1.65	160.14
54 G. Clarke.....	27.00	6.28	17.58	28.10	14.55	13.55	1.92	159.40
55 M. J. Donnelly.....	28.90	5.90	14.70	30.80	13.20	14.30	2.08	157.74
56 A. S. McCres.....	27.60	5.70	16.14	28.60	15.90	16.75	2.38	156.31
57 A. C. Parsons.....	28.80	5.00	15.18	25.50	16.45	13.15	1.62	155.15
58 G. G. Rodgers.....	29.70	6.74	15.48	26.50	13.75	14.60	2.46	154.61
59 T. H. Matthews.....	26.70	5.70	15.96	26.90	14.15	14.60	2.76	154.04
60 J. W. Dreaser.....	27.50	5.40	16.20	25.70	14.30	13.40	2.35	153.54
61 E. H. Craig.....	28.30	5.84	13.25	26.90	13.98	13.80	1.60	151.81
62 S. H. Williamson.....	26.90	5.00	14.25	25.90	13.85	14.10	1.65	150.99
63 T. L. Bonfils.....	26.60	6.50	12.45	26.80	12.80	13.00	2.08	150.33
64 W. W. Russell.....	25.70	5.36	13.35	26.00	14.56	17.75	2.83	150.10
† I. McJunkin.....	30.90	5.76	17.00	27.70	17.35	14.75	0.32	161.70
† M. Craven.....	35.00	6.46	15.00	24.10	15.05	14.20	2.34	159.13
† J. D. Crenshaw.....	30.60	4.76	17.16	26.30	12.25	14.05	1.47	157.37
† F. Parker.....	28.00	6.42	14.55	23.40	15.95	18.45	2.82	154.55
† W. A. Gresham.....	28.60	6.48	14.50	26.70	12.55	13.55	0.99	151.49
† A. C. Oliphant.....	27.10	5.50	13.95	26.00	14.05	13.25	0.39	148.96
† G. E. Perry.....	25.60	5.70	13.80	24.30	15.55	13.75	2.43	147.61
† S. H. Wright.....	27.40	5.80	14.50	25.80	13.05	13.75	1.42	147.54
† Z. B. Vance.....	27.00	5.58	13.35	23.50	13.10	13.40	2.59	146.06
† L. T. McKee.....	27.00	5.22	14.00	22.70	13.95	13.05	2.30	144.74
† D. Morgan.....	24.00	4.88	12.75	26.40	14.20	13.05	1.53	144.37
† J. H. Lindsey.....	24.50	4.62	13.55	25.50	14.95	13.25	2.26	143.93
† Y. Kuoys.....	27.30	5.20	13.30	16.60	14.50	.....	0.38	104.50

CADET-MIDSHIPMEN.

Merit-roll of third class (48 members), annual examination, June, 1880.

Order of annual merit.	Name.	Seamanship.	Trigonometry.	Analytical geometry.	Descriptive geometry.	Physics and chemistry.	History and rhetoric.	French.	Drawing.	Conduct.
	Maxima.....	12	32	28	12	16	24	20	8	
*1	L. Nixon.....	9.66	31.60	28.63	11.55	14.68	21.60	16.05	7.42	1.24
2	S. S. Wood.....	10.68	29.76	23.17	10.80	12.40	19.56	15.35	7.80	0.34
3	J. T. Arnold.....	8.52	28.64	26.04	11.55	13.84	17.58	13.25	7.60	1.57
4	L. S. Bennett.....	9.00	25.28	21.70	9.30	12.88	21.24	16.85	6.90	1.68
5	E. W. Sutphen.....	11.13	25.52	22.33	10.83	11.72	19.32	13.30	7.82	0.77
6	W. R. M. Field.....	9.00	25.12	24.92	9.69	11.72	18.84	16.40	5.70	1.08
7	W. B. Fletcher.....	9.96	24.88	21.77	10.17	12.12	19.68	13.80	7.48	0.52
8	M. Johnston.....	9.12	25.52	23.31	10.02	12.16	18.24	14.85	6.60	1.24
9	H. A. Horst.....	9.45	24.88	19.88	8.58	12.60	18.66	17.60	6.96	0.77
10	L. Semple.....	9.06	23.60	22.47	8.28	11.76	18.66	16.85	6.88	1.34
11	W. L. Howard.....	9.18	24.96	19.25	9.45	10.36	17.88	17.05	7.50	0.97
12	H. H. Kenkel.....	10.11	26.32	19.39	10.44	11.80	16.08	12.85	7.78	1.07
13	W. B. Whittelsey.....	9.87	24.64	20.37	9.69	12.04	17.64	12.50	7.46	0.67
14	J. J. Blandin.....	9.00	22.16	20.16	9.09	11.84	19.38	15.75	7.08	1.34
15	W. N. King, jr.....	9.51	24.56	18.34	9.06	10.68	18.78	16.50	7.10	1.74
16	J. G. Doyle.....	9.45	23.44	21.56	9.18	12.08	18.12	12.75	7.10	1.22
17	J. G. McWhorter.....	9.24	25.20	22.19	9.15	11.04	17.94	13.25	5.76	1.43
18	W. T. Paine.....	7.65	24.00	22.75	8.22	10.88	16.68	16.75	5.96	0.71
19	T. C. Prince.....	9.36	22.88	18.97	10.17	11.96	17.70	14.05	7.48	0.34
20	E. A. Anderson.....	8.97	22.32	20.37	9.54	12.92	18.72	14.20	6.86	1.01
21	W. J. Grambs.....	9.00	23.60	21.14	8.88	11.08	17.10	13.20	7.72	1.64
22	L. R. Savage.....	8.34	23.28	21.21	9.27	11.08	17.82	13.40	5.68	0.67
23	A. L. Key.....	8.16	23.52	21.84	8.25	11.12	18.72	13.45	5.66	1.68
24	C. Martin.....	8.10	24.96	19.46	7.74	10.64	17.52	15.55	5.24	0.87
25	W. B. Duncan.....	9.72	21.12	19.11	9.00	11.16	15.42	18.65	5.84	1.77
26	J. J. Conway.....	9.60	22.00	18.60	7.71	10.00	19.32	14.90	6.12	1.02
27	J. M. Poyer.....	7.71	24.16	18.62	8.19	10.92	19.38	14.25	5.22	1.84
28	H. H. Eames.....	10.17	22.72	17.50	9.09	10.88	16.32	13.70	7.62	1.77
29	F. H. Stahle.....	8.34	21.52	17.85	7.77	10.60	17.16	15.50	6.46	1.68
30	N. M. Hubbard.....	8.64	21.04	19.18	8.40	10.40	17.16	13.35	6.80	1.77
31	C. J. Dudley.....	9.24	22.64	18.13	9.51	10.00	16.02	13.20	5.54	1.41
32	L. S. Gwyn.....	8.55	18.32	21.77	7.50	10.64	16.08	13.50	5.00	1.17
33	H. Fowler.....	8.49	18.16	17.85	7.44	10.28	16.92	13.50	6.38	1.54
34	F. F. E. Lodeman.....	8.37	18.40	17.92	7.41	10.08	15.54	14.10	5.88	1.64
†	J. L. Jayne.....	9.87	23.04	20.86	10.32	11.76	17.16	12.20	7.18	1.77
†	G. E. Kent.....	8.61	21.44	17.50	9.27	10.20	15.84	12.20	7.64	1.54
†	W. E. Morris.....	9.09	20.80	15.89	8.97	10.96	16.26	11.85	7.72	1.54
†	J. W. Smythe.....	8.82	20.40	17.15	8.52	10.00	15.78	11.65	7.60	0.77
†	S. A. W. Patterson.....	8.82	20.64	17.71	8.25	10.40	16.14	11.90	5.78	1.64
†	P. N. McGiffen.....	9.30	20.00	17.29	7.26	10.44	16.20	13.10	5.10	1.22
†	E. N. Bell.....	8.70	18.96	17.99	7.59	9.20	18.24	11.00	6.62	1.22
§	W. P. Hoke.....	9.18	19.12	17.92	7.38	8.84	16.92	13.70	5.34	1.64
§	J. A. Lamkin.....	7.32	20.16	16.24	6.96	10.36	16.20	11.80	6.58	0.34
†	O. D. Norton.....	7.05	20.00	16.73	8.10	10.04	15.24	12.55	5.82	1.44
†	G. M. von Schrader.....	6.60	19.28	15.05	7.56	9.44	15.72	11.90	6.68	1.54
†	S. Ashby.....	6.03	20.00	16.31	6.99	7.56	15.54	13.20	5.20	1.34
†	T. W. Hayden.....	7.77	20.16	14.84	6.87	7.20	14.40	13.05	6.10	1.94
	F. A. McNutt.....	a	24.16	a	a	a	a	a	5.80	0.34

CADET-MIDSHIPMEN.

Merit-roll of fourth class (60 members), annual examination, June, 1880.

Order of annual merit.	Name.	Seamanship.	Mathematics.	History and Eng. lish.	French.	Drawing.	Conduct.	Aggregate.
	Maxima.....	8	32	20	8	8		76
*1	Samuel D. Greene, jr.....	7.34	30.56	17.55	6.96	6.52	0.28	68.65
*2	George W. Street.....	7.10	31.60	17.30	6.18	6.46	0.30	68.34
*3	John B. Jackson.....	6.66	29.76	17.50	6.54	6.96	0.19	67.23
*4	Charles E. Sweeting.....	6.38	30.24	16.85	6.16	7.10	0.74	65.99
5	William E. Bowman.....	6.44	28.16	17.10	6.52	6.70	0.36	64.56
6	Thomas H. Gignilliat.....	6.50	27.76	15.05	5.76	7.50	0.48	62.09
7	Edmund E. Kiefer.....	5.82	27.36	14.95	6.08	6.22	0.52	59.91
8	Robert H. Woods.....	6.32	24.48	15.70	6.54	6.68	0.26	59.46
9	Charles F. Hepp.....	6.42	23.52	16.10	6.18	7.42	0.19	59.45
10	Benjamin E. Thurston.....	5.88	25.52	14.35	6.50	7.30	0.18	59.37
11	Patrick H. Philbin.....	6.00	25.44	15.20	6.06	7.02	0.61	59.11
12	Robert T. Frazier.....	6.32	24.24	16.45	6.20	5.88	0.42	58.67
13	Alfred P. Agee.....	6.26	26.08	15.60	5.56	5.68	0.54	58.64
14	Cyrus T. Brady.....	5.90	24.16	16.60	6.40	6.62	1.10	58.58
15	Albion S. Keith.....	6.06	24.40	15.00	5.96	7.14	0.31	58.25
16	William A. Megrath.....	6.10	26.64	14.20	5.38	6.38	0.48	58.22
17	Harry George.....	6.06	24.00	16.25	5.90	6.40	0.58	58.03
18	Harry H. Balthis.....	6.26	23.68	15.90	5.46	6.52	0.38	57.44
19	Elton W. Dalrymple.....	5.58	25.36	14.70	5.96	6.22	0.78	57.04
20	Michael E. Lennon.....	5.78	23.44	16.45	5.00	6.22	0.42	56.47
21	Frederick L. Chapin.....	6.06	21.68	15.00	6.06	7.16	0.24	55.72
22	John H. Barnard.....	6.54	22.32	13.95	6.18	7.44	0.76	55.67
23	John A. Jackson.....	6.10	22.24	15.95	6.04	5.82	0.63	55.52
24	Alexander B. Legaré.....	5.42	23.84	13.80	5.90	6.80	0.58	55.18
25	George C. Stout.....	5.94	21.76	15.25	5.46	7.06	0.33	55.14
26	Thomas A. Witherspoon.....	6.90	22.40	14.40	5.26	6.48	0.30	55.14
27	Edwin B. Weeks.....	6.22	24.24	13.75	6.18	5.68	1.01	55.06
28	Tremlet V. Toney.....	6.30	21.60	15.50	5.38	6.44	0.44	54.78
29	Sidney Z. Mitchell.....	5.94	23.04	14.25	6.28	5.82	0.72	54.61
30	Willie T. Gray.....	6.12	22.32	14.00	6.02	6.52	0.48	54.50
31	Timothy S. O'Leary.....	6.06	21.28	14.15	6.10	6.70	0.36	53.93
32	Charles R. Reynolds.....	5.52	22.88	13.35	5.62	6.74	0.29	53.82
33	James J. G. Cooper.....	5.56	22.08	15.60	5.28	5.66	0.71	53.47
34	William W. Ricketts.....	5.76	23.76	13.40	5.16	5.68	0.29	53.47
35	Robert L. Lerch.....	5.88	20.80	14.35	6.26	5.90	0.14	53.05
36	Robert C. Alexander.....	5.22	20.80	14.30	5.50	7.30	0.28	52.84
37	Frank R. Colvin.....	5.08	20.80	15.45	5.84	5.46	0.39	52.24
38	Edwin G. Temple.....	5.36	20.40	15.60	5.22	5.38	0.21	51.75
39	Arthur Dovalé.....	5.14	20.88	12.95	6.34	5.88	0.74	50.45
40	William J. Wilson.....	5.54	20.80	12.90	5.16	5.60	0.22	49.78
41	Thomas B. Smith.....	5.40	20.32	14.00	5.38	5.08	1.20	48.98
†	Harry C. Pettit.....	5.38	20.32	13.70	4.72	6.30	0.52	49.90
†	James F. Carpenter.....	5.54	19.68	13.95	5.00	5.88	0.58	47.47
†	Edward E. Solomon.....	5.08	21.20	13.85	4.80	5.06	0.93	47.06
†	William H. Ledbetter.....	4.78	20.16	13.45	5.66	5.30	0.50	48.85
†	Josiah S. McKean.....	5.56	21.44	12.25	4.90	5.42	1.20	48.28
†	Foxhall A. Parker.....	5.32	20.00	13.00	4.86	4.96	0.64	47.34

CADET-MIDSHIPMEN—Continued.

Merit-roll of fourth class (60 members), annual examination, June

Order of annual merit.	Name.	Seamanship.	Mathematics.	History and Eng- lish.	French.
	Maxima	8	32	20	8
†	Charles P. Plunkett	5.62	19.52	12.55	5.28
‡	Leon H. Jastremski	4.30	20.32	10.80	5.22
‡	Alonzo E. McIntire	5.22	16.48	13.25	4.84
§	Harry Rankin	5.40	18.48	11.85	5.00
§	Wirt McCreary	5.96	14.40	13.20	4.42
†	Edward R. Cassidy	6.26	14.48	10.70	5.00
§	John A. McCook	5.22	14.24	12.40	4.16
‡	Raymond R. W. B. Stevens	5.24	14.00	11.65	5.66
‡	Charles R. Mitchell	4.56	14.40	12.35	3.48
‡	Frederick H. Sparling	6.10	13.92	10.00	5.00
§	Arlington L. Lovenskiold	4.54	12.32	11.75	5.66
‡	Harlem Peasey	a	a	a	a
	Louis M. Wentworth	a	a	a	a

CADET-ENGINEERS.

Merit-roll of first class (18 members), annual examination, June, 1890, and general merit-roll for four years.

Order of general merit.	Name.	Ship-building.	Mechanical drawing, and fabrication.	Designing machinery, and marine engines.	Heat and light.	Physical measurements.	Mechanics.	Naval architecture, and method of least squares.	Naval architecture (elective).	Public law.	Spanish.	Demonstrations.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
	Maxima.....	16	56	88	24	28	44	24		12	12		304	228	152	76	760
1	Albert William Stahl.....	13.08	50.68	79.20	23.74	25.20	38.88	23.32	3.00	11.04	9.81	2.85	273.05	206.10	137.21	68.11	684.47
2	William Frederic Durand.....	14.28	49.42	79.20	22.50	24.85	39.82	22.50	3.12	10.89	10.08	2.40	274.26	205.10	135.56	61.92	676.84
3	William Frederick Converse Hasson.....	12.36	45.22	61.82	22.38	25.90	34.54	20.34	2.28	10.68	9.00	4.50	239.33	191.90	137.19	69.07	637.49
4	Leo Dwight Miner.....	13.16	44.66	62.92	19.86	25.20	34.76	21.00	2.16	9.45	8.31	1.62	239.86	187.67	123.88	63.09	614.50
5	Winfield Scott Sample.....	12.48	45.78	71.06	19.26	24.15	37.07	20.16	2.40	9.39	9.15	1.35	249.55	180.47	118.92	59.33	608.27
6	Arthur Tennant Woods.....	12.08	49.56	66.44	18.36	22.54	33.77	20.16	2.16	9.27	9.00	3.33	240.01	176.59	120.14	56.70	596.44
7	Joseph Learned Wood.....	11.52	42.84	59.84	18.72	25.90	35.31	16.44	0.60	10.29	9.72	2.82	238.36	178.26	119.50	59.27	585.39
8	Charles Edward Manning.....	13.08	47.04	66.22	18.06	21.00	32.34	15.90	.....	9.03	8.64	1.65	229.66	171.40	110.80	55.30	567.16
9	Harry Hall.....	13.36	39.06	66.22	19.08	21.84	38.72	19.80	2.16	9.99	9.12	1.14	238.21	165.84	107.88	59.64	562.47
10	William Hillary Alderdice.....	11.76	42.00	58.52	16.74	22.75	29.81	17.34	1.82	9.39	8.82	6.51	211.94	172.74	117.19	55.69	557.56
11	Albert Osborne Young.....	10.36	43.26	59.62	16.86	25.20	31.24	16.50	.....	9.33	8.73	1.65	219.45	168.47	111.62	55.85	555.39
12	Albert Edward Smith.....	12.12	47.32	61.82	17.58	23.10	28.38	17.22	.....	9.60	8.43	3.72	221.85	193.05	107.38	56.26	553.54
13	Charles Alfred King.....	12.28	40.74	61.60	18.54	23.10	31.24	16.86	0.60	10.17	9.15	3.24	221.04	167.62	105.77	54.13	548.56
14	Thomas Wright Kinkaid.....	11.36	40.60	56.32	19.20	24.50	28.27	16.74	.....	9.81	8.16	3.09	211.87	167.30	109.35	55.80	544.32
15	William Dixon Weaver.....	9.92	42.00	58.74	17.70	18.34	29.37	16.20	.....	10.05	9.21	4.89	206.43	157.55	103.13	51.16	518.27
16	John Leeds Worthington.....	10.72	39.20	55.22	15.90	17.50	28.27	16.26	.....	8.79	9.00	1.53	198.64	157.92	99.13	53.02	508.71
17	William Strother Smith.....	10.20	39.76	55.22	16.08	21.00	26.84	16.08	.....	8.82	8.55	3.54	199.01	155.02	97.19	49.71	500.93
18	Clarence Herbert Mathews.....	11.00	39.34	54.12	16.74	23.10	29.48	16.68	.....	9.03	8.46	3.90	204.05	160.91	101.11	50.22	516.29

CADET-ENGINEERS.

Merit-roll of second class (27 members), annual examination, June, 1880.

Order of annual merit.	Name.	Mechanical drawing.	Fabrication of machinery.	Designing machinery.	Astronomy.	Heat and light.	Mechanics and applied mathematics.	Composition.	French.	Conduct.
		Maxima	20	24	32	16	40	56	20	20
1	Jay M. Whitham.....	17.40	19.74	26.56	12.76	33.00	52.08	13.90	13.50	0.77
2	Gustave Kaemmerling ..	16.10	18.48	23.76	13.00	31.20	45.22	16.40	15.40	1.16
3	Oliver B. Shallenberger..	16.55	20.34	26.00	13.96	31.50	39.48	17.05	14.90	1.83
4	Llewellyn F. Whittle.....	16.35	19.68	24.16	13.72	32.90	38.92	17.20	16.70	2.52
5	Charles E. Belden	15.70	18.06	22.16	12.20	31.80	40.18	14.70	15.60	0.66
6	James E. Byrne	15.65	19.62	22.96	12.32	31.00	40.04	15.55	14.35	2.04
7	Kenneth McAlpine.....	14.05	18.30	22.00	11.84	28.60	42.42	16.45	17.00	2.26
8	De Witt C. Redgrave.....	16.15	17.34	23.92	11.88	29.20	38.92	17.70	14.15	1.05
9	Frank B. Dowst	15.60	18.18	23.12	11.96	29.20	37.94	17.05	16.30	1.44
10	William T. Webster.....	16.00	20.04	23.12	12.20	29.20	37.24	16.30	14.25	1.52
11	Lloyd Bankson.....	14.40	18.18	23.52	11.80	29.90	40.04	14.75	13.70	1.06
12	Thomas J. Hogan	17.75	20.04	21.28	12.72	26.20	38.64	14.70	15.00	2.04
13	William W. White	15.20	17.34	22.00	11.00	28.70	39.48	16.10	14.00	1.56
14	William S. Smith	14.95	18.00	22.72	12.12	32.40	35.28	14.85	12.75	0.97
15	Isaac B. Parsons	17.25	19.20	23.20	11.28	26.30	36.54	15.80	12.50	2.40
16	Robert Stewart, jr.....	13.05	16.74	20.88	12.64	28.10	35.98	17.25	15.90	0.88
17	Lyman B. Perkins	16.25	17.28	21.92	11.64	28.20	36.40	14.40	14.05	2.17
18	Bias C. Sampson	14.80	17.70	22.16	12.16	26.90	36.26	13.50	13.35	1.35
19	Arthur R. Bush	15.25	18.78	21.92	10.52	28.20	37.10	12.05	14.00	2.59
20	Robert J. Beach	15.00	18.42	20.80	10.20	25.80	35.00	15.10	12.60	2.53
†	Martin A. Anderson.....	16.65	18.90	23.28	11.24	24.40	36.68	15.65	16.00	1.66
†	Solon Arnold	13.80	16.86	19.68	11.72	25.00	35.00	16.50	16.10	1.66
†	Herman Eckel	14.10	15.90	16.40	10.68	26.60	35.14	16.55	17.65	0.92
†	William H. Gartley.....	14.10	17.82	19.36	10.24	25.10	38.08	15.80	13.60	2.35
†	Albert Moritz	14.65	16.44	19.60	10.56	27.20	35.00	14.70	14.55	1.61
†	Andrew McAllister	14.35	19.74	16.72	10.16	25.10	32.20	16.70	13.95	1.62
	William Lang.....	14.35	a	a	a	a	a	16.55		1.03

CADET-ENGINEERS.

it-roll of third class (28 members), annual examination, June, 1890.

name.	Trigonometry.	Analytical geometry.	Descriptive geometry.	Mechanical drawing and fabrication.	Physics and chemistry.	History, composition and rhetoric.	French.	Conduct.	Aggregate.
ima	24	28	20	20	16	24	20		152
ss	23.58	27.16	19.10	16.20	15.32	22.56	19.40	1.22	142.10
. Gatewood..	23.22	28.91	18.95	14.55	14.08	21.00	18.45	1.62	137.54
I. P. Creigh-									
.....	22.62	24.64	17.55	15.45	11.96	21.36	17.45	0.52	130.51
. Ferguson..	21.36	24.57	18.95	17.30	13.60	18.72	15.15	0.26	129.39
er	20.70	25.27	16.85	15.05	13.88	21.24	16.50	1.36	128.13
itts	19.50	24.71	16.75	15.65	12.76	20.28	18.40	1.34	126.71
. Chambers ..	18.90	22.82	18.30	16.15	19.20	21.24	15.90	0.87	125.94
Rommell....	18.66	23.38	17.85	15.85	11.00	20.28	15.70	0.47	122.25
Donant	18.24	19.67	15.95	16.00	12.72	19.20	16.10	0.76	117.12
Clarke	18.66	20.58	15.85	13.85	11.80	20.58	16.30	1.11	116.51
Lawthorne ..	18.42	19.95	16.10	15.15	11.32	20.04	14.20	0.95	114.23
Day	18.36	20.44	15.65	15.55	11.44	17.46	14.70	0.66	112.94
antner	16.56	20.30	15.40	16.30	11.80	16.38	16.70	1.41	112.03
. Willis	16.44	20.72	14.35	14.10	11.84	19.56	15.65	1.48	111.13
Pendleton....	17.28	20.09	14.65	14.00	12.56	18.06	14.85	1.52	109.97
sonard	16.14	20.72	14.85	13.65	11.08	19.02	14.65	0.77	109.34
Higgins	15.84	19.67	16.00	15.80	11.08	16.68	15.05	0.95	109.17
Vinchell	15.54	18.62	15.15	16.70	10.96	16.32	14.85	1.20	106.94
. Howland....	17.58	17.50	13.85	14.35	10.84	18.42	15.20	1.07	106.67
Gladstone....	15.54	19.11	14.60	14.35	10.68	17.10	14.50	1.56	104.32
Addicks	15.42	18.27	14.80	15.10	10.48	18.12	13.30	1.70	103.79
Leopold	15.00	19.46	14.15	14.95	11.76	15.90	13.10	1.63	102.69
E. Coley	15.00	17.64	13.45	14.40	10.32	15.54	14.50	1.69	99.16
. Taylor	15.84	16.73	14.10	14.20	10.48	16.08	14.10	0.63	100.90
uinby	14.52	18.48	13.50	14.75	10.08	15.30	15.80	1.69	100.74
. W. Shock...	13.08	17.99	13.40	13.30	9.04	15.72	12.80	0.54	94.70
Tonchi	12.72	15.40	14.35	14.95	7.08	12.18	.....	0.09	76.59
Simpson	15.00	a	a	14.35	a	a	a	1.11	.....

CADET-ENGINEERS.

Merit-roll of fourth class (25 members), annual examination, June, 1880

Order of annual merit.	Name.	Mathematics.	Mechanical drawing.	English and history.	French.
	Maxima.....	36	12	20	8
*1	Charles E. Woodruff.....	35.46	9.51	17.55	6.36 0.
*2	Samuel W. Armistead.....	34.11	9.72	17.35	6.30 0.
*3	William J. Baxter.....	33.21	9.48	18.40	6.22 0.
*4	John M. Ellicott.....	33.66	9.48	17.25	6.92 0.
*5	Charles P. Eaton.....	33.21	9.18	16.90	7.10 0.
6	Charles E. Barnes.....	31.77	9.27	17.75	5.96 0.
7	William F. Darrah.....	31.05	9.18	16.75	6.60 0.
8	Charles W. Dyson.....	30.96	9.06	16.35	5.52 0.
9	George F. Zinnell.....	29.79	9.21	16.70	5.62 0.
10	George W. Littlehales.....	28.44	8.85	17.25	5.70 0.
11	William S. Aldrich.....	30.24	9.96	13.65	5.36 0.
12	Alexander S. Halstead.....	28.71	8.94	15.95	5.80 0.
13	Harry A. Field.....	28.53	8.55	14.10	5.40 0.
14	Charles J. Gross.....	27.54	9.30	13.85	6.08 0.
15	William B. Carswell.....	27.09	8.82	15.25	5.28 0.
16	Charles F. Webster.....	27.54	8.49	14.30	5.28 0.
17	Harry A. Gillis.....	25.65	8.55	13.85	5.76 0.
18	Philip J. Ryan.....	26.28	8.46	13.70	5.12 0.
19	Julius Ellenger.....	26.01	8.16	14.25	4.78 0.
20	William H. Lawrance.....	24.12	9.12	13.05	5.00 0.
†	William C. Herbert.....	26.28	7.95	13.40	5.38 0.
†	James E. Palmer.....	25.83	9.15	12.10	5.06 0.
†	Eustace S. Glascock.....	25.11	7.56	13.95	5.00 0.
†	Marius Duvall, jr.....	23.67	8.67	12.45	4.72 1.0
‡	Thomas P. Pattison.....	a	a	a	a 0.0

REGULATIONS

GOVERNING

ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; one appointed at large. According to the act of Congress approved June 17, 1874, "There shall not be at any time more in said Academy appointed at large than ten. As it will take some time before the number now at the Academy can be reduced to ten, there will be no appointment at large for at least two years to come.

The nomination of candidates for admission from the District of Columbia and the Territories is made by the President. The nomination of a candidate from any Congressional district or Territory is made on the recommendation of the Member or Delegate for that district or Territory.

Each year, as soon after the 5th of March as possible, Members and Delegates are notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts not represented in Congress. They will be filled by appointments from the districts in which the vacancies exist.

The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 11th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the June examination, will be examined on the 22d of September following; should any candidate fail to report, or be found physically or mentally disqualified for admission, in June, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined on the 11th of September following. When any of the dates assigned for examinations fall on a Sunday, the examination will take place on the following Monday.

Only persons of sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the vexation and disappointment consequent upon failure, by accepting nominations tempting to enter a service for which they are not fitted.

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States approved July 27, 1898.

EXAMINATION.

Each candidate for appointment as Cadet-Midshipman must present to the Academy

demic Board satisfactory testimonials of good moral character, a *honor* to his precise age, which must be over fourteen and less than the time of the examination. No candidate will be examined whose within the prescribed limits.

VII. Candidates must be physically sound, well formed, and of ro they will be required to pass a satisfactory examination before a n posed of the surgeon of the Naval Academy and two other medica ignated by the Secretary of the Navy.

VIII. Any one of the following conditions will be sufficient to cat a candidate :

Feeble constitution, inherited or acquired ;

Greatly retarded development ;

Permanently impaired general health ;

Decided cachexia, diathesis, or predisposition ;

All chronic diseases or results of injuries that would permanently

viz :

Weak or disordered intellect ;

Cutaneous and communicable diseases ;

Unnatural curvature of spine, torticollis, or other deformity ;

Permanent inefficiency of either of the extremities or articulation

Epilepsy or other convulsions within five years ;

Impaired vision or chronic disease of the organs of vision ;

Great hardness of hearing or chronic disease of the ears ;

Chronic nasal catarrh, ozena, polypi, or great enlargement of the

Impediments of speech to such an extent as to impair efficiency i of duty ;

Chronic diseases of heart or lungs or decided indications of lial pulmonary affections ;

Hernia or retention of testes in inguinal cavity ;

Sarcocoele, hydrocele, stricture, fistula, or hæmorrhoids ;

Large varicose veins of lower limbs, scrotum, or cord ;

Chronic ulcers.

Attention will also be paid to the stature of the candidate, and under size for his age will be received at the Academy. In the case physical condition of the candidate, any marked deviation from the height will add materially to the consideration for rejection. Five minimum height for the candidate.

The board will exercise a proper discretion in the application of th to each case, rejecting no candidate who is likely to be efficient in cl mitting no one who is likely to prove physically inefficient. No can the board will be allowed a re-examination.

IX. The candidates must pass a satisfactory examination before cl in reading, writing, spelling, arithmetic, geography, and English g

X. All the examinations, except in reading, will be written. C below the standard will receive a second and final examination in th they fail. Deficiency in any one of the subjects at the second exami ficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have another examination for admission to the same class unless recomme of Examiners."—(*Reg. Stat.*, § 1515.)

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is r in figures any whole number, decimal, or mixed number, to write a number, and to explain the Roman and Arabic systems of notation

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of common and small fractions, and is expected to be able to give clearly the reasons for such processes, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as of small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetic.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those found in school arithmetics. It is essential that the candidate should be thoroughly proficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of Algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and sea; the character of coast-lines; the direction and position of mountain-chains and the locality of important peaks; the position and course of rivers, their tributaries, the bodies of water into which they empty; the position of important seas, bays, straits, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes, and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance (attention is specially called to the rivers and bodies of water in which cities are situated); the course of a vessel in making a voyage between known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as found in the common-school text-books, embracing the following subjects: The divisions of letters and the use of capitals; the parts of speech; the classification of nouns, and the distinctions of person, gender, and number; under *number*, the rules for formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, changes in ending to denote case; the difference between the definite and indefinite article, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for *comparing adjectives*; irregular defective comparison; numerals and their classification; the double classification of *nouns*, first, into substantives and adjectives; secondly, into personals, relatives, and pronouns, peculiarities in the use of personal pronouns, as the difference between *my* and *me*, between *thou* and *you*, and the various uses of *it*; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective

pronouns, or pronominal adjectives, and their classification: the conjugation of *verbs*: the relations between transitive and intransitive principal parts of regular, irregular, and defective verbs: the uses of auxiliaries: the essential peculiarities in the use of voice, mood, tense, person; tense endings and personal endings: impersonal verbs: the formation, and comparison of *adverbs*: conjunctive adverbs: the use of *interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, syntax.

Parsing, according to the following model: giving in the case of each word an explanation of its grammatical relation to the other words in the sentence.

Noun: Class, gender, number, person, case.

Article: Definite or indefinite; qualified noun.

Adjective: Class, compared or not compared; comparison, if admitted; of comparison; qualified noun.

Personal pronoun: Person, gender, number, case.

Relative pronoun: Person, gender, number, case, antecedent.

Interrogative pronoun: Gender, number, case.

Adjective pronoun (or pronominal adjective): Class; qualified word.

Verb: Class, form, principal parts, tense, mood, voice, person, number.

Adverb: Class, derivation and comparison, if derived and compared.

Preposition: Words between which the relation is shown by the preposition.

Interjection: The kind of emotion expressed.

Conjunction: Class; words or sentences connected.

READING.—Candidates will be examined in reading aloud English prose.

WRITING AND SPELLING.—Candidates will be required to write a short composition, and an exercise in dictation, and to spell twenty-four words in connection with the composition.

An examination in English branches containing eight or more mistakes will not be considered satisfactory, and will be sufficient of itself to reject the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations and appointments as Cadet-Midshipmen, and become inmates of the Academy will be required to sign articles by which he binds himself to serve the United States Navy eight years (including his time of probation at the Academy) unless sooner discharged. The pay of a Cadet-Midshipman is \$500 a year, and he is allowed a gratuity of \$500 at the date of his admission.

XIV. Cadets, immediately after their admission, will supply themselves with the following articles; viz.,

One parade-suit.....	\$37 72	* Eight pairs socks.....
One undress-suit.....	20 95	* Four pairs drawers.....
One working-suit.....	2 42	* Six handkerchiefs.....
One overcoat.....	23 30	* Eight towels.....
One rubber coat.....	3 65	Two pairs drill-gloves.....
One pair rubber leggings.....	1 05	Two pairs Lisle-thread gloves.....
Two pairs white duck leggings.....	2 34	* One pair suspenders.....
One pair gymnastic slippers.....	92	One neck-tie.....
One parade-cap.....	3 60	Two clothes-bags.....
One undress-cap.....	1 71	One hair mattress.....
* Two pairs high shoes.....	11 50	One straw mattress.....
* Eight white shirts.....	10 16	One hair pillow.....
* Two night-shirts.....	1 76	One pair blankets.....
* Four undershirts.....	2 24	Two bedspreads.....
Twelve linen collars.....	1 65	Six sheets.....

cases.....	\$1 00	One pass-book.....	\$0 27
brush.....	22	One stencil and ink; 1 brush.....	41
rush.....	73	One bottle indelible ink.....	17
.....	23	One rug.....	1 55
comb.....	10	One wash-basin and pitcher.....	1 05
omb.....	31	One looking-glass.....	95
.....	09	One water-pail.....	70
soap.....	10	One slop-bucket.....	70
sh.....	09	One broom.....	27
tion-book.....	32		
r-book.....	27	Total.....	164 86

es marked *, not being required to conform to a standard pattern, may be the cadet from home, but all other articles must conform to the regulation, therefore, be supplied by the storekeeper.

et-Midshipman must, on admission, deposit with the paymaster the sum which he will be credited on the books of that officer, to be expended, by the Superintendent, in the purchase of text-books and other authorized articles those enumerated in the preceding article.

deposits for clothing and the entrance-deposit of twenty dollars must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

clothing.....	\$164 86
books, &c.....	20 00
deposit required.....	184 86

of clothing brought from home is to be deducted from this amount.

et-Midshipman, *one month after admission*, will be credited with the amount of expenses in traveling from his home to the Academy.

det-Midshipman who voluntarily resigns his appointment within a year of his admission to the Academy will be required to refund the amount paid for traveling expenses.

R. W. THOMPSON,
Secretary of the Navy.

EXAMINATION OF CANDIDATES FOR ADMISSION MIDSHIPMEN, 1880.

ARITHMETIC.

SEPTEMBER, 1880.—Time allowed, three hours.

1. What is the rule for dividing one decimal by another? Explain off as stated in the rule. Divide .046 by .00762039 to four decimal places.

2. Add together 1.465, .0095, 37.15, 28.457, and 16.1635, and divide the sum by 1.25. Divide 345 lbs. 9 oz. 16 dwts. 20 grs. by 13½.

3. Simplify $2\frac{1}{2} + \frac{1}{2}$ of $\frac{7}{3\frac{1}{2}} - \frac{1\frac{1}{2}}{2\frac{1}{2}} \} \div 1\frac{1}{2}\frac{1}{2}$.

4. Take $\frac{1}{3}$ of £4 10s. 9d. from £6 6s. 9d. What simple fraction is the remainder equivalent to $\frac{17s. 7\frac{1}{2}d.}{£11 9s. 2\frac{1}{2}d.}$?

5. Having several numbers already separated into their prime factors, would you select to form (1) the greatest common divisor; (2) the least common multiple?

6. Separate each of the following numbers into its prime factors, least common multiple (not to be multiplied out): 13500, 49302, 4511022011.

7. Given that one metre = 39.37079 inches, that one kilogramme = 2.2046226 pounds, and that a gun throws a shot of 134 pounds 5½ ounces a distance of 4 miles, press the weight of the shot in kilogrammes and the range in metres.

8. A box with a lid measures externally 16 inches each way, and the lid is made 1 inch thick: what would be the weight of the box if it were made of paper weighing 792 ounces and a cubic foot of paper weighs 48 pounds?

9. Find the square root of .18 to seven decimal places.

10. The length of the year is 365 days 5h. 48m. 48sec. Express this in decimals to seven places. What would have been the date to-day if the year had been 365 days exactly from the beginning of the Christian era no leap years had been introduced?

ENGLISH BRANCHES.

JUNE, 1880.—Time allowed, three hours.

GRAMMAR.

1. Decline (or inflect) *who, I, country, beef, chimney.*

2. Give the principal parts of *lead, burst, strive, blow, catch, clear, fall.*

3. Name the adverbs corresponding to *shy, able, cruel, worthy.* What is the active verb? a participle? gender?

4. Correct the following, and state why any of the words are wrong. 'Fair, you will give the same help to him and I. When I had set down a man come up and said, 'Why do you lay there for such a awful lon.'

5. Parse the words in italics:

'It is not at once that the inhabitants of a great city, accustomed to the sight of war, realize the idea of scarcity.'

SPELLING.

	Compliance.	Financier.	Levy.
.	Subservient.	Gross.	Sponsor.
l.	Dissension.	Perpetrate.	Antiquated.
nce.	Unforeseen.	Confessor.	Equivocal.
	Malicious.	Exhaust.	Iceicle.
nd.	Autograph.	Penetrate.	Bayonet.

GEOGRAPHY.

re is the White Sea? Black Sea? Red Sea? Yellow Sea?
 re is Ancona? Sydney? Batavia? Salonica? Chattanooga?
 e the rivers on which the following cities are situated, tell which of them
 als, and name the States in which they are: 1. Monte Video. 2. Liverpool.
 1. 4. Saint Paul. 5. Cincinnati.
 ribe the following rivers, telling where they rise, in what direction they
 into what water they empty: 1. Cumberland. 2. Godavary. 3. Oder. 4.
 5. Columbia.
 the position of the following and tell to what nation each belongs: 1. Canary
 2. Cochin China. 3. Mauritius. 4. Corsica. 5. Hong-Kong.

RE-EXAMINATION.

ARITHMETIC.

SEPTEMBER, 1880.—*Time allowed, three hours.*

de .1 by .01, .01001 by .001, 99 by .0009, and 8886.66 by .00037. What decimal
 33251 of 32.44?
 many bars of gold, each weighing 5 oz. 13 dwts. 21 gra., can be made from
 ighing 88 lbs. 8 oz. 14 dwts. 15 gra.?
 iple the sum of $\frac{1}{4}$, $1\frac{1}{2}$, and $\frac{3}{4}$ by the difference of $\frac{1}{15}$ and $\frac{1}{20}$, and divide the
 y $1\frac{1}{4}$ of $1\frac{1}{2}$.
 iple together $\frac{2687}{317}$, $\frac{1167}{66}$, $\frac{111}{66}$, and $\frac{11111}{6666}$, cancel all the factors you can, and
 result in its simplest form.
 e the rule for finding the greatest common divisor of two numbers when the
 are so large that you cannot find their prime factors; explain the rule, i. e.,
 ons for it.
 l the greatest common divisor of 93883 and 167027.
 uare field contains 3 acres 1 rood 13 poles $5\frac{1}{2}$ square yards; find the length
 much will it cost to carpet a square room, whose side is 17 feet 6 inches, with
 feet 4 inches wide, at 3s. 9d. per yard?
 posing that the limited express runs 40 miles an hour and an ordinary train
 in hour, and that the express fare is 1 cent per mile more than the ordinary
 l how much an hour a man's time is worth if it costs him the same to travel
 by the other.

ENGLISH BRANCHES.

JUNE, 1880.—*Time allowed, three hours.*

GRAMMAR.

I.

he words in italics in the following passage: "I know *you do not like* trouble,
we ventured, notwithstanding, to make you the *executor* of my will. *There will*
uch to do, as there is no *money*. There is a little bequest, *having* reference to
that you might like to execute."

N A B

II.

Correct and point out the faults in the following passage: "He ain't a bit done it, and there arn't no use in talking about those kind of things. No one has any regard for himself would start for the Arctic regions in February. I wanted to do this, but it seemed to me sort of foolish, and when I heard he talked to him, but he acted like he was mad."

III.

1. Give the principal parts of *shed, slay, bring, sing, sink, drown*.
2. Give the superlative of *shy*; of *lovely*; of *inconvenient*. Give the positive, *worse, last, next*.
3. Inflect (or decline) *hero, dwarf, leaf, treaty*.

SPELLING.

Artificial.	Machinery.	Channel.	Treble.
Mitten.	Electricity.	Salmon.	Cemetery.
Congregate.	Literary.	Whereabouts.	Pestilence.
Subscription.	Disagreeable.	Volley.	Proficient.
Liquor.	Excellent.	Conscientious.	Artifice.
Commodity.	Prosecutor.	Corroborate.	Pioneer.

GEOGRAPHY.

1. Where, and on what water, is Smyrna? Newcastle? Austin? Asuncion? erick?
2. From what part of what country and into what water do the following currents flow? 1. Cape Clear. 2. Cape St. Roque. 3. Cape St. Vincent. 4. Cape Race. 5. Cape Race.
3. Describe the following rivers, telling where they rise, in what direction they flow, and into what water they empty: 1. Red River. 2. Orange River. 3. Don River. 4. Tigris River. 5. Clyde River.
4. Name three seaports on the east coast and three on the west coast of America, and fix the position of each.
5. Fix the position of the following, and state to what country or countries they belong, naming a town in each place: 1. Iceland. 2. Guiana. 3. Jamaica. 4. Philippines. 5. Philippine Islands.

REGULATIONS

FOR THE

MENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

assurance of law, applications will be received by the Navy Department for ment of Cadet-Engineers.

Application is to be addressed to the Secretary of the Navy, and can be made by the candidate or by any person for him, and his name will be placed on the registry of a name, however, gives no assurance of an appointment, and no will be given in the selection to priority of application.

The number of appointments which can be made is limited by law to twenty-five per year. The candidate must not be less than sixteen or more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academy of Arts and Sciences, and to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of character and health, with information regarding date of birth and educational attainments hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September for examination as to their qualifications for admission.

The course of study will comprise four years at the Naval Academy, and two years at sea. All Cadets who finally graduate will be commissioned Assistants in the Navy as vacancies occur. The pay of a Cadet-Engineer while at the Naval Academy is \$500 per annum.

The academic examination previous to appointment will be competitive, and will cover the following subjects, namely: Arithmetic; algebra, through equations of the second degree; plane geometry; rudimentary natural philosophy; reading; writing; English grammar; English composition; geography; free-hand drawing; and elementary knowledge of the principles governing the action of the steam-engine. Candidates who possess the greatest skill and experience in the practical knowledge of the steam-engine, *other qualifications being equal*, will have precedence for admission. The examination before the Medical Board is the same as that of candidates for the rank of Cadet-Midshipmen. See p. 60.

Banking deposits must be made before a candidate can be received into the

£ (see p. 62).....	\$164 86
and drawing instruments.....	50 00
.....	214 86

Candidates who contemplate presenting themselves as candidates for admission as Cadet-Engineers are cautioned that the number of applicants is large, and the competition is exceedingly close. It is, therefore, useless for candidates to present themselves for examination on the subjects of the examination, and unless their physical condition is within the proscribed standard.

Time allowed, three hours.

1. Divide 723 by .0000241; divide .000368 by 184000; reduce the common fraction in its lowest terms. What fraction of £2 19s. $\frac{31}{4}$ of $(3\frac{3}{4} + 1\frac{3}{8})$ of 13s. $1\frac{1}{2}$ d. to make the sum equal to £3 5s. $\frac{1}{4}$?

2. Multiply together $1\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $9\frac{5}{12}$, $1\frac{1}{3}$. Express 14s. 1d. 4d. A tradesman's prices are 15 per cent. above cost price; if he sells for \$2 on a bill of \$46, what per cent. of profit does he make? Find the interest on 13s. 9d. for 191 days at $5\frac{1}{2}$ per cent. (365 days to the year).

3. Given the prime factors of several numbers, explain how you find (1) the greatest common divisor, (2) the least common multiple. Find the least common multiple of the following numbers into its prime factors: 1001, 259289, 2499. The greatest common divisor of two numbers is 13×21 the least common multiple is $99 \times 49 \times 169$, and one of the numbers is 39039. Find the other number.

4. At 19 cents per square yard, what will be the cost of paving a room, length 20 feet $10\frac{1}{2}$ inches, breadth 15 feet $1\frac{1}{2}$ inches. Find the square root of 818 to seven decimal places.

5. On what day of the week will the 21st of September fall in 2080? After how many exact centuries from to-day will the fall on Tuesday? Give a full explanation of the calculation. Add together $\frac{2}{3} + \frac{1}{4} + \frac{5}{6} + \frac{7}{8} + \frac{1}{12}$ and express the sum as a common fraction.

6. On the 21st of September, 1880, you buy five notes for such a sum that you may receive 8 per cent. per annum on them. The notes are for \$100 each, they were all given on March 21, 1881, at 6 per cent. *payable annually*; the notes fall due as follows: (1) March 21, 1882, (2) March 21, 1883, (3) March 21, 1884, (4) March 21, 1885, (5) March 21, 1886. How much should you pay for the notes?

ALGEBRA.

Time allowed, three hours.

1. Divide

$$(ax + by)^3 + (ax - by)^3 + (bx - ay)^3 + (bx + ay)^3 \text{ by } (a + b)$$

Separate into factors $(aB + bA)(cD + dC) - (aD + bC)(cA + dB)$

If $x = y + \frac{1}{z}$ and $y = z + \frac{1}{x}$, prove that $z = x - \frac{2}{y}$. A person traveling on a rail- counts the number of telegraph posts that he passes during $1\frac{1}{2}$ minutes; this ber is equal to the number of miles he travels in half an hour; find the distance reen two consecutive posts.

In the equation $12y^2 + 7xy - 12x^2 + 20y + 110x - 600 = 0$, substitute $(y-2)$ for y and $(x+4)$ for x ; in the resulting equation put $\frac{3x+4y}{5}$ in place of y , and $\frac{4x-3y}{5}$ in place of x , and reduce the result to its simplest form. How could the final result be deduced from the first equation by a single substitution? Prove this.

GEOMETRY.

Time allowed, two hours and a half.

Prove that the angles at the base of an isosceles triangle are equal, and that if equal sides be produced the angles on the other side of the base will be equal. If ABC is an isosceles triangle, BC the base; if the angles ABC and ACB be bisected by lines BE and CD , respectively meeting AC and AB in E and D , prove that straight lines BD , DE , and EC will be equal to each other.

Prove that the angle at the centre of a circle is double the angle at the circumference on the same arc. AB and CD are two chords of a circle which intersect, when produced, in the point E , without the circle; prove that the difference of the arcs subtended at the centre of the circle by the arcs AC and BD is double the angle AEC .

Inscribe a square and an equilateral triangle in a circle and explain the construction. If AB be the side of the square, and AD the side of the triangle, prove that $3AB^2 = 2AD^2$.

A straight line BC is divided in G , and on BC and BG , on opposite sides of B , are described the squares $ABCD$ and $BEFG$: A point P is taken between A and B , and $EP = AB$, and PF is joined. The parallelogram $FPDN$ is drawn: show that it is a square equal to the sum of the other two, and that the triangles PAD and N are equal in all respects.

Find the length of the side of a regular octagon, inscribed in a circle of radius a . Suppose that if circles be described with the corners of a square as centres, with a radius equal to one-half of the diagonal, the points where these circles cut the sides of the square will be the vertices of a regular octagon.

NATURAL PHILOSOPHY.

Time allowed, three hours.

Give the laws of gravitation.

A ball weighs 1,470 pounds at the surface of the earth; what would it weigh 10,000 miles above the surface, the radius of the earth being 4,000 miles?

A body falls 357.23 feet in 4 seconds; what was its initial velocity, the measure of the force of gravity being 32.16?

A body falls from a certain height, and 3 seconds after it has started, another body falls from the height of 787.92 feet; from what height must the first fall if both are to reach the ground at the same instant?

What is the horse-power of an engine that can raise 1,500 pounds 2,376 feet in 3 seconds?

A railway car weighing 10 tons is moved 50 feet from rest and acquires a velocity of 25 miles per hour; determine the work expended on the car in foot-pounds, the resistance due to friction being 8 pounds per ton.

A stone is thrown horizontally from the top of a tower 257.28 feet high with a velocity of 60 feet a second; where will it strike the ground?

Find the energy of a 25-pound ball that has fallen 3,600 feet in a non-resistant medium.

5. If 5 quarts of water weigh as much as 7 quarts of alcohol, find the weight of alcohol.

A piece of cork weighing 2.3 grains was attached to a piece of iron weighing 26.2 grains, both were found to weigh in water 26.2 grains, the iron alone weighed 26.2 grains in water; required the specific gravity of the cork.

6. A weight of 12 pounds, hanging from one end of a five-foot lever having no weight, balances a weight of 8 pounds at the other end; fulcrum must be moved in order that the weights may balance when by 2 pounds?

If a two horse-power engine can just throw 1,056 pounds of water to the top of a steeple in two minutes, what is the height of the steeple?

7. A ship passing from the sea into a river discharges 44,800 pounds of water found to sink in the river to the same mark as in the sea; the specific gravity of the water being 1,028, find the weight of the ship and cargo.

A body weighing 12 pounds (sp. gr., $\frac{1}{2}$) is fastened to the bottom of a vessel by a cord; water being poured in until the body is covered, find the tension of the cord.

How high could a liquid with a specific gravity of 1.35 be raised by a pump when the barometer stands 29.5 inches, the specific gravity of mercury being 13.6?

8. If the capacity of the barrel of an air-pump is $\frac{1}{2}$ that of the receiver, how much air will remain in the receiver at the end of the fourth stroke of the pump?

A hollow copper sphere whose internal diameter is 2 feet, just floats in water, find the thickness, the specific gravity of copper being 8.788.

ENGLISH BRANCHES.

Time allowed, three hours.

GRAMMAR.

1. (a) Give the possessive, singular and plural, of *hoof, moss, foliage*. (b) What is meant by the mood or mode of a verb? Name the moods and give the use of any two of them.

2. (a) "I know what I am doing." State what two classes of pronouns are represented by *what*. (b) "The man that I saw yesterday said that that was wrong." Explain the different uses of *that*. (c) Correct the following sentences if they are wrong: 1. Who did she marry? 2. Three-fourths are more than half. 3. It is the duty of everyone to be careful of their reputation. 4. The man and his wife were fortunate, but neither of them were to blame.

3. Parse the words in italics in the following: "He observed, *that even if he were guilty, he had been fully proved, still, all together did not, according to the law, amount to a capital crime.*"

SPELLING.

Delegation.	Precursor.	Typical.	Incessant.
Inalienable.	Synagogue.	Installation.	Bladder.
Counterbalance.	Pasillanamous.	Sorcery.	Disaster.
Quarantine.	Conscience.	Nuptial.	Coast.
Inveigle.	Euphonious.	Fustian.	Miss.
Courtesy.	Predecessor.	Hoax.	Effect.

GEOGRAPHY.

1. Where and on what water are the following cities? 1. Antwerp. 2. Bagdad. 4. Nashville. 5. Fredericton.

2. Give the source, direction, and mouth of the following rivers: Congo. 3. Amoo. 4. Niemen.

3. Fix the position of the following islands and state to what country they belong: 1. Heligoland. 2. Santa Maura. 3. Barbadoes. 4. Funen.

4. Fix the position of the following and tell to what division of the world each name refers: 1. Suez. 2. Marne. 3. Constance. 4. Mendocino. 5. St. Louis.

5. Name in order the States of Europe bordering on the seacoast, and give the capital of each, and the name of one other principal city.

COURSE OF INSTRUCTION.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.*—Description of all kinds of rope, and its practical manipulation for purposes on shipboard; measuring for and fitting standing and running rigging; masting, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; the fittings of boats; the management of boats under various circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging; in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seamanship, with lectures and illustrations from models.

SHIP-BUILDING.

Text-books.—Thearle's Naval Architecture and Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and maneuvering of a fleet, under oars or sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics (Parker); United States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and spars.

NAVAL TACTICS.*—Exercises in boats under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal Code.

NAVAL TACTICAL SEAMANSHIP.*—Exercises on board the United States sloop-of-war Dale on Saturday mornings.

The instruction in boxing, gymnastics, swimming, and dancing is in charge of this Department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery*, as laid down in Ordnance and Gunnery Instructions for the United States Navy.

SEPARATION of gun-iron from crude ore, including the description and use of furnaces; manufacture of wrought-iron, steel, and bronze; fabrication of guns of all calibers; manufacture of gunpowder and fuses, and of all kinds of projectiles and fire-works.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial, terminal, and final velocities, and the methods of determining their values; the effect of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent sights and determination of their range; penetration and shock of projectiles; and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.*—Organization and formation of squad, company, and battalion; drill of the soldier; company and battalion drill, including instructions for bayonet and the bayonet exercise.

Text-books.—United States Infantry Tactics; Wingate's Rifle Practice.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

*Cadet Midshipmen only.

TRIGONOMETRY.—Analytical investigation of trigonometric application to all the cases of plane and spherical trigonometry; use of trigonometric tables; the solution of trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane; discussion of the general equation of the second degree, involutes; determination of loci; principal problems relating to the and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of geometry, and the application of the method, particularly to the sphere and to the construction of maps.

Text-books.—Ray's Higher Algebra; * Todhunter's Algebra for Engineers; * Wentworth's Geometry; † Chauvenet's Trigonometry; Descriptive Geometry; Millar's Descriptive Geometry; * Todhunter's Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth class, who show ability in mathematics are permitted to take an advanced course in the elective courses for 1880-81.

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, trigonometry and to geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and Schools; * Todhunter's Equations; Rice and Johnson's Elements of the Differential Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification of marine steam-engines, and of instruments and apparatus used in the computation of the power and its cost; instruction in the operation of the room watch and of the engineer division, by means of practical instruction on the United States steamers Nantucket and Standish under the command of the commanding officers.

FABRICATION OF MACHINERY.*—The qualities and strength of materials, the processes of manufacture, accompanied by practical exercises.

Text-books.—Weisbach's *Mechanics of Engineering*, Vol. II *; Northcott's *Steam-Engine* †; Warren's *Elements of Mechanical Drawing* †; Goodeve's *Elements of Mechanism*; † Rankine's *Machinery and Mill-Work*; † Rankine's *Steam-Engine and other Prime Movers*; † Zeuner's *Valve-Motion*; † and Shelley's *Workshop Appliances*; † King's *Lessons and Notes on the Steam Engine*.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—Descriptive and practical astronomy, including the use of instruments, especially those used for determining terrestrial latitudes and longitudes; the solution of the astronomical triangle; the use of the *Nautical Almanac*.*

Text-books.—C. J. White's *Astronomy*; Theory of the portable Transit and the Zenith Telescope; Coffin's *Navigation*; * Bowditch's *Navigator*.*

NAVIGATION.—Theory and practice of navigation, the latter including instruction in the duties of the navigator, the use of navigating instruments, and their construction, with the solution of problems and the use of tables.

Text-books.—Coffin's *Navigation*; Howell's *Mathematical Theory of the Deviations of the Compass*; Bowditch's *Navigator*; Howell's *Marine Surveying*.

SURVEYING.—The form of the earth, with special reference to the construction of charts; explanation of geodetical surveys; the solution of problems in nautical surveying, and practical work in surveying and constructing charts.

Text-book.—Howell's *Marine Surveying*.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ACOUSTICS.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Statical electricity; dynamical electricity; magnetism; electro-magnetism; electrical measurements; thermo-electricity; applications of electricity.

CHEMISTRY.—General chemistry.

EXPERIMENTAL LECTURES ON PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; effects of heat; instruments used for the measurement of heat; thermodynamics.

PHYSICAL MEASUREMENTS.†—In this course the Cadets are permitted to elect between work in the physical laboratory and work in the chemical laboratory.

The work in the physical laboratory during the year 1880 consisted in the calibration of two thermometers, and in the preparation of tables for the correction of the readings of these and several others; determination of the ratio of the arms of a chemical balance; determination of coefficient of torsion; determination of specific gravities; determination of the specific heat of various specimens of boiler scale, and an investigation of the thermal conductivity of boiler scale; measurement of the focal length of lenses, and the index of refraction of glass and of water containing different quantities of Na Cl in solution; photometric observations; experiments with the spectroscope, saccharimeter, and diffraction bank; measurements of the resistance of batteries of various forms and working under different conditions; comparison of the resistances of the various sets of resistance coils in the laboratory; determination and comparison of the constants of three tangent galvanometers; an investigation of the changes in electrical resistance of carbon due to changes in pressure.

The work in the chemical laboratory during the year 1879-80 embraced blowpipe analysis; crystallography; mineralogy; quantitative analysis.

* Cadet-Midshipmen only.

† Cadet-Engineers only.

The course in mineralogy comprised the study in the mineral cabinet of the commonly-recurring minerals, the useful ores, and the objectionable ones frequently associated with them.

The course in quantitative analysis consisted of the gravimetric determination of iron in ammonio-ferrous sulphate.

Copper and tin in gun-metal.

Copper, antimony, and zinc in "white brass."

Tin and lead in solder.

Lead, carbon dioxide, and insoluble residue in a white lead ground.

Valuation of a coal.

The preparation and standardizing of a solution of potassic permanganate of iron wire, ammonio-ferrous sulphate, oxalic acid, and ammonic oxalate.

The estimation of iron in an iron salt, and in hematite and magnetite, by the permanganate solution.

Preparation and standardizing of a solution of potassic dichromate.

Estimation of iron in an iron salt by Penny's method.

Text-books.—Stewart's Elementary Physics; Eliot and Storer's Chemistry; Jenkins's Magnetism and Electricity; Stewart's Elementary Treatise on Inorganic Chemistry; Kohlrausch's Physical Measurements; Nason's Blowpipe Analysis; Dana's Manual of Mineralogy; Thorpe's Quantitative Analysis.

Cadet-Engineers of the first class have additional practical exercises in analysis every Saturday morning, while the Cadet-Midshipmen exercise in ship.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the calculus, including Taylor's theorem, applications to problems of maxima and minima, and the tracing of curves; the methods of integration and the application of the integral calculus to areas, surfaces, and volumes, and to the finding of centers of gravity and moments of inertia, and to simple cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, cohesion, and cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium; motions of translation and of rotation of bodies about an axis; central forces; the simple and the compound pendulum; the laws of motion; work and conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium; the flotation of bodies; the stability and oscillations of floating bodies; gravity; the motion of liquids. *Aëriiform fluids.*—Laws of pressure; weight of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

THE STRENGTH AND RESISTANCE OF MATERIALS.*—Simple and compound stresses; the relations between strain, stress, and resilience; the strength of materials; beams; beams of uniform resistance.

THE METHOD OF LEAST SQUARES.*—The theory of the method of least squares; the application of the method to results derived from experiments.

THEORETICAL NAVAL ARCHITECTURE.*

Text-books.—Rice and Johnson's Differential Calculus; Williamson's Calculus; Todhunter's Mechanics for Beginners; Smith's Hydrostatics; Alex. Smith's Mechanics; * Rankine's Applied Mechanics; * Merriman's Method of Moments; * Wilson's Theoretical and Practical Ship-Building.*

ELECTIVE COURSES.

Cadets who have completed the elective course in mathematics are permitted to take an advanced course in the integral calculus and in analytical mechanics.

* Cadet-Engineers only.

The course in theoretical naval architecture is elective for Cadet-Midshipmen. There is also an elective course in theoretical naval architecture for Cadet-Engineers.

Text-books.—Williamson's Integral Calculus, and Tait and Steele's Dynamics of a Particle; Thearle's Theoretical Naval Architecture; Lectures on the mathematical theory of naval architecture.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States.—International law: rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicil; privateering; prizes; *jus postliminii*; rights and duties of neutrals; contraband; blockade; right of search; ship's papers; offenses against the law of nations.—Outlines of maritime law.

Text-books.—Woolsey's International Law; Andrews's Manual of the Constitution.

HISTORY.—Outlines of history, especially the history of Greece and Rome, and of the states of Western Europe down to 1880; historical geography; progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's General Sketch of History, with Labberton's Historical Atlas; Eliot's History of the United States, with modern atlases.

RHETORIC AND COMPOSITION.—Essential properties of style; classification of sentences; rules for the construction of sentences; figures of rhetoric; exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH.—Historical development of the English language; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation. Etymology. Syntax; analysis of sentences.—Reading from standard authors. Classification of words; definition of words by usage and by derivation; synonyms; laws of change in the meaning of words.—Faults in diction, and their remedies; selection and arrangement; elementary principles of reasoning.

Text-books.—Tancock's English Grammar and Reading Book; Seeley and Abbott's English Lessons; Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.—Grammar; exercises in reading, writing, and conversation.

SPANISH.—The course in Spanish is elective.

Text-books.—Keetel's French Grammar; La Fontaine's Fables; Prud'homme's French Nautical Phrases; Erckmann-Chatrian's *Le Conscrit* and *Waterloo*; Gasc's Dictionary; Roget's Spanish Manual; Tolon's Reader; Barretti's Dictionary.

DEPARTMENT OF DRAWING.

Free-hand drawing and practical perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are arranged in four classes, each class pursuing the course for the corresponding year.

PROGRAMME OF RECITATION

The time devoted to daily recitations is divided into three periods, indicated thus: (1) denotes first period, from 8.16 a. m. to 10.16 a. m.; (2) denotes second period, from 10.16 a. m. to 12.16 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m.

Practical exercises begin on Saturdays at 8 a. m. from October 1 to December 15, and to June 1; and at 10.45 a. m. from December 15 to March 10. On other days, except Saturdays, exercises begin at 4 p. m.

FIRST TERM.

From October 1, 1880, to January 29, 1881.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS.		
Seamanship	M. (3)	Seamanship
Mathematics	M. T. W. Th. F. (2) S. (1)	{ Algebra and Elective con
English Studies, History, and Law	M. T. W. Th. F. (1)	English and
Modern Languages	{ First division, T. Th. (3) Second division, W. F. (3)	{ Keutel's Fr
Drawing	{ First division, W. F. (3) Second division, T. Th. (3)	{ Free hand d
THIRD CLASS.		
Seamanship	W. (3)	Seamanship
Mathematics	M. T. W. Th. F. (1)	Trigonomet geometry, once a we
English Studies, History, and Law	F. (3)	Descriptive
Modern Languages	M. T. Th. (3)	English and
Drawing	M. W. F. (2)	French and Spanish
	T. Th. (2) S. (1)	Topograph
SECOND CLASS.		
Seamanship	Th. (3)	Lucas's Sur
Ordnance and Gunnery	F. (3)	Infantry ta Instru
Astronomy, Navigation, and Sur- veying	M. (2) T. (3) S. (1)	Astronomy
Mechanics and Applied Mathe- matics	M. W. Th. F. (1) T. (2)	{ Calculus Elective co
English Studies, History, and Law	W. (2)	English and
Modern Languages	M. (3) Th. (2)	French and Spanish
Physics and Chemistry	F. (2) W. (3) T. (1)	Chemistry
FIRST CLASS.		
Seamanship	T. (3) F. (1)	Ship Bui
Ordnance and Gunnery	M. W. (2)	Lucas's Sur
Steam-Engineering	Th. S. (1) F. (2)	Ordnance
Astronomy, Navigation, and Sur- veying	W. Th. F. (3)	Marine eng
Physics and Chemistry	M. T. W. (1)	Navigatio
	M. (1) T. Th. (2)	Electroni

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
FOURTH CLASS.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra, geometry, and descriptive geometry. Elective course once a week.
Engineering	M. T. Th. (3)	Mechanical drawing and fabrication.
Studies, History, and Law	M. T. W. Th. F. (1)	English and history.
Languages	W. F. (3)	Keetel's French grammar.
THIRD CLASS.		
Mathematics	M. T. W. Th. F. (1)	Trigonometry and descriptive geometry. Elective course once a week.
Engineering	W. (3)	Descriptive geometry.
	T. Th. (2) F. (3) S. (1)	Mechanical drawing and fabrication.
Studies, History, and Law	M. T. Th. (3)	English and history.
Languages	M. W. F. (2)	French and elective course in Spanish.
SECOND CLASS.		
Engineering	M. (2) T. Th. F. (3)	Mechanical drawing, fabrication of machinery, and marine engines.
Mathematics and Applied Mathematics	M. W. Th. F. (1) T. (2)	Calculus.
Studies, History, and Law	W. (2)	Elective course twice a week.
Languages	M. (3) Th. (2)	English and history.
		French, and elective course in Spanish.
Physics and Chemistry	F. (2) T. S. (1) W. (3)	Chemistry and heat.
FIRST CLASS.		
Ship-Building	T. (3) F. (1)	Ship-Building.
Engineering	M. T. W. Th. S. (1) W. Th. F. (3)	Marine engines, fabrication, designing machinery, and mechanical drawing.
Physics and Chemistry	M. (3) Th. T. (2)	Electricity.
Mathematics and Applied Mathematics	M. W. F. (2)	Strength of materials.

SECOND TERM.

From January 31, 1881, to June 1, 1881.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS.		
Seamanship	M. (3)	Seamanship.
Mathematics	M. T. W. Th. F. (2) S. (1)	{ Algebra and geo Elective course
English Studies, History, and Law	M. T. W. Th. F. (1)	English and hist
Modern Languages	First division, T. Th. (3)	{ French.
	Second division, W. F. (3)	
Drawing	First division, W. F. (3)	{ Free-hand draw pigraphy
	Second division, T. Th. (3)	
THIRD CLASS.		
Seamanship	Th. (3)	Seamanship.
Mathematics	M. T. W. Th. F. (1)	Analytical geom.
	T. (3)	Elective course
Physics and Chemistry	T. Th. F. (2)	Descriptive geom.
English Studies, History, and Law	M. W. (3) S. (1)	Elementary phys.
Modern Languages	M. W. (2) F. (3)	English and hist.
		French and elect
		Spanish.
SECOND CLASS.		
Seamanship	W. F. (3)	Lucy's Seamanship.
Ordnance and Gunnery	Th. (2)	Naval tactics.
Astronomy, Navigation, and Surveying	T. Th. (3)	Infantry tactics.
Mechanics and Applied Mathematics	F. (2) S. (1)	Ordnance Instruction.
		Astronomy.
English Studies, History, and Law	M. T. W. Th. F. (1)	{ Mechanics. Elective course
	One period a month	
Modern Languages	M. (3) T. (2)	English composition.
Physics and Chemistry	M. W. (2)	French and elect.
		Spanish.
		Heat.
FIRST CLASS.		
Seamanship	M. W. (2)	Lucy's Seamanship.
Ordnance and Gunnery	W. (3) F. S. (1)	Ordnance and art.
Steam-Engineering	M. Th. (3) T. (2)	Marine engines.
Astronomy, Navigation, and Surveying	M. T. W. Th. (1)	Navigation and astron.
Mechanics and Applied Mathematics	T. (2)	Elective course.
English Studies, History, and Law	T. F. (3)	French.
Modern Languages	Th. F. (2)	Public law.
		French and elect.
		Spanish.

CADET-ENGINEERS.

Departments.	Periods.	Subjects.
FOURTH CLASS.		
Mathematics	M. T. W. Th. F. (2) S. (1)	Algebra, geometry, and descriptive geometry. Elective course once a week.
Engineering	M. (3)	Descriptive geometry.
Studies, History, and Law Languages	W. F. (3)	Mechanical drawing and fabrication.
	M. T. W. Th. F. (1)	English and history.
	T. Th. (3)	French and elective course in Spanish.
THIRD CLASS.		
Mathematics	M. T. W. Th. F. (1)	Analytical and descriptive geometry. Elective course once a week.
Engineering	Th. (3)	Descriptive geometry.
	T. (3)	Mechanical drawing and fabrication.
and Chemistry	T. Th. F. (2)	Elementary physics.
Studies, History, and Law Languages	M. W. (3) S. (1)	English and history.
	M. W. (2) F. (3)	French and elective course in Spanish.
SECOND CLASS.		
Engineering	T. W. (3) Th. F. (2) S. (1)	Mechanical drawing, fabrication of machinery, and marine engines.
and Chemistry	M. W. (2)	Heat.
ces and Applied Mathematics	M. T. W. Th. F. (1)	Mechanics.
Studies, History, and Law Languages	One period a month	Elective course twice a week.
	M. (3) T. (2)	English composition.
on	Th. F. (3)	French and elective course in Spanish.
		Descriptive astronomy.
FIRST CLASS.		
Engineering	M. T. W. Th. F. (1)	Marine engines, fabrication, designing machinery, and mechanical drawing.
and Chemistry	T. (2) Th. (3)	Physical measurements.
ces and Applied Mathematics	M. W. (3)	The method of least squares.
	M. W. (2) S. (1)	Naval architecture.
Studies, History, and Law Languages	T. F. (3)	Naval architecture, elective course.
	Th. F. (2)	Public law.
		French and elective course in Spanish.

EXAMINATION PAPERS—1879-80.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

JANUARY, 1880.—Time allowed, four hours.

1. Simplify $(cx + by)^2 + (cr + dy)^2 + (ay - bx)^2 + (cy - dx)^2$, expressing the product of two factors. Given $r = (a^2 - b^2 - c^2 + d^2)$, separate 4 into four factors.

2. Find the G. C. D. of $3x^4 - 10x^3 + 9x^2 - 2x$, and $2x^4 - 7x^3 + 2x^2 + 7x$ of $3x^3 - 14x^2 + 16x$, and $x^3 - 7x^2 + 16x - 12$; and reduce $\frac{x^5 + 5bx^4 - b^2x^3}{x^4 + 3bx^3 - b^2x}$ to lowest terms.

3. Simplify—

$$\frac{2}{x} - \frac{1}{a+x} + \frac{1}{a-x}; \quad \frac{a+b-c}{a-b+c} + \frac{b-c-a}{a+b-c} - \frac{4(b-c)^2}{a-(b-c)^2}$$

and

$$\frac{a^2+a+1}{(a-b)(a-c)} + \frac{b^2+b+1}{(b-a)(a-c)} + \frac{c^2+c+1}{(c-a)(c-b)}.$$

4. Solve the equations $\frac{3x+7}{14} - \frac{2x-7}{21} + 2\frac{1}{4} = \frac{x-4}{4}$;

$$\frac{6x-7\frac{1}{2}}{13-\frac{1}{2x}} + 2x + \frac{1+16x}{24} = 4\frac{5}{8} - \frac{12\frac{1}{2}-x}{3}.$$

5. $(\sqrt{x+2})(\sqrt{x+6}) = (\sqrt{x+3})(\sqrt{x+4})$; $(x+5)(y+7) = (x+1)(2x+10) + 3y+1$; $\sqrt{y} - \sqrt{(a-x)} = \sqrt{(y-x)}$; $2\sqrt{(y-x)} = 3\sqrt{(a-x)}$.

6. Find the square root of $3\frac{1}{2} - \sqrt{10}$, and of $ax^2 + by^2 - 2xy\sqrt{ab}$. Find of $17 + 12\sqrt{2}$. Simplify $(x-1-\sqrt{-2})(x-1+\sqrt{-2})(x-2+\sqrt{-3})$

and $(a^2 + a^{\frac{1}{2}}b^{\frac{1}{2}})^{\frac{1}{2}} + (b^2 + b^{\frac{1}{2}}a^{\frac{1}{2}})^{\frac{1}{2}}$.

7. Solve the equations $\frac{x-1}{x+1} + \frac{x+3}{x-3} = \frac{2(x+2)}{x-2}$; $(x-c)\sqrt{(ab)} = (a-$

$x)\sqrt{(x^2-y^2)} - 4\frac{1}{2} = \frac{x-\sqrt{(x^2-y^2)}}{x+\sqrt{(x^2-y^2)}}$; $x(x+y) = 52 - \sqrt{(x^2+xy)}$

Develop $(x^2-y)^{-\frac{1}{2}}$ to five terms by the binomial formula.

8. There are p Arithmetical Progressions, each beginning with 1, and differences are 1, 2, 3, &c., up to p ; find the sum of the n th terms of the j . If the p th term of a Geometrical Progression is P , and the q th term is Q , find the n th term.

9. Given $y = 2(a-x)(x+\sqrt{x^2+b^2})$, find the greatest value that y can have for real values of x , and find the corresponding value of x .

Find x and y from the equations—

$$a(x+b)^2 - b(x+a)^2 = b(y+b)^2 - a(y+a)^2, \\ x^2 - 2y(a+b) = y^2 + a^2 + b^2.$$

ALGEBRA.

JUNE, 1880.—Time allowed, three hours.

1. Solve the equations $\frac{x+2}{x-1} - \frac{4-x}{2x} = \frac{7}{3}$; $x^2 + \sqrt{(x^2+5)} = 11$,

and $x + 2 - \frac{6}{x+2} = 1$.

2. Find y in terms of x from the equation $y^2 - 6xy + 8x^2 - 8y + 27x + 11 = 0$.

Find x and y from the equations $x^2 + y^2 = a^2$, $y = mx + a\sqrt{(m^2+1)}$.

3. Find x and y from the equations $y = mx - 2am - am^3$, $y^2 = 4ax$.

4. Develop $\sqrt{(1-3x-4x^2)}$ to four terms by means of indeterminate coefficients. Find the sum of n terms of the series $(1)^2 + (2)^2 + (3)^2 + \dots$

Separate $\frac{x^2-2x+3}{(x-1)(x-2)(x-3)}$ into partial fractions.

5. Define the terms *logarithm*, *antilogarithm*, *base*, *modulus*, *arithmetical complement*.

Find the values of the following expressions by means of logarithms $(373.56)^{1.7}$, $.0028569^{\frac{1}{3}}$, $(.36525)^{-\frac{1}{2}}$, $\frac{\log_{10} .0036545}{\log_{10} .67264}$, $(.75862)^{.75862}$.

6. Find the value of the expression $\left\{ \frac{a^3bc^2d^4 + 100}{e^2fg^6} \right\}^{\frac{1}{2}}$ given $a = 10795$, $b = .00064521$, $= .0087595$, $d = .000053812$, $e = 317880$, $f = .0083542$, $g = .98985$.

7. Eliminate m between the two equations $y = \frac{2m}{1-m^2}(x-a)$, and $y + ma = \frac{m^2-1}{2m}x$,

and show that $(x^2 + y^2 - 2ax)[(x-a)^2 + y^2] = 0$.

8. Find the value of x from the equations

$$y = mx + \frac{m(b^2-a^2)}{\sqrt{(b^2m^2+a^2)}}, \text{ and } a^2y^2 + b^2x^2 = a^2b^2.$$

GEOMETRY.

JUNE, 1880.—Time allowed, three hours.

1. Prove that the three perpendiculars from the vertices of a triangle upon the opposite sides meet in a point (P). $ABCD$ is a parallelogram, E and F the middle points AD and BC respectively; show that BE and DF will trisect the diagonal AC .

2. Inscribe a circle in a given triangle: Upon a line 1'.5 long construct a segment contain an angle of 30° . (Give full proof of constructions.) Find the radius of a circle inscribed in a right triangle whose sides are a and b .

3. Prove that if from a point without a circle a tangent and a secant be drawn, the tangent is a mean proportional between the whole secant and its external segment. Prove that in any triangle the product of two sides is equal to the product of the segments of the third side formed by the bisector or the opposite angle together with the square of the bisector.

4. Divide a given line in *extreme and mean ratio*; find expressions for the segments, noting the whole line by a . How may the square root of any number be constructed? In a right triangle BAC , the angle B is 30° , and the side $AC = a$: find the segments of the side AC by the bisector of the angle B .

5. Prove that the volume of a triangular pyramid is equal to one-third the product of its base and altitude. State and prove the proposition which gives the volume of a frustum of a triangular pyramid.

6. Find the volume of a solid composed of a cylinder ($r = 5$, $h = 6$) surmounted by a frustum ($r_1 = 5$, $r_2 = 3$, $h = 4$), the whole capped by a segment of a sphere such that its centre of the sphere is at the centre of the upper base of the cylinder.

7. Given an isosceles triangle side a , base $2b$, find, by means of similar triangles,

1. Show how to find the traces of a line. Find the point of intersection of two oblique planes (two methods).

2. Find the intersection of two planes (1) when both traces meet and the horizontal traces are parallel, (2) when one trace is on G , (3) when the traces are parallel to G , (4) when neither trace is on G , (5) when the traces intersect within the limits of the drawing.

3. Find the angle between two oblique planes. Through a given point draw a line which shall make a given angle with a given oblique plane.

4. (1) Through a given point draw a line to make a given angle with a given plane. (2) Through a given point pass planes, making a given angle with a given plane. When is (1) impossible? When is (2) impossible?

5. Given the three face-angles of a trihedral angle, $\alpha = 60^\circ$, $\beta = 70^\circ$, $\gamma = 80^\circ$; find the three dihedral angles. Given two face-angles $\alpha = 45^\circ$, $\beta = 60^\circ$, and the angle between them 30° ; find the other face and dihedral angles.

6. Pass a tangent plane at a given point on a cylinder of radius 1".25, make a right section of it, and develop the portion of the cylinder between the cutting plane and the ground line.

7. A frustum of a right circular cone rests with its larger base on the ground line. The radius of this base is 2", and its centre C , is 2".5 from the ground line. The height of the frustum is 2" in length and make an angle of 45° with H . On the top of the frustum is placed an inverted cone, the vertex being at C , with the upper base of the frustum. Denote an element of the frustum by AB , A being in the lower base and B in the upper base. (1) to construct the projections of the two surfaces; (2) to construct the projections of the section of the frustum by a plane perpendicular to AB at a point P ; (3) to find the points where the section of the inverted cone through the point where the cutting plane meets the cutting plane; (4) to find the points where these two surfaces intersect.

CURVE TRACING (ELECTIVE).

JUNE, 1880.—Time allowed, four hours.

Cadet-Engineers C. E. Woodruff, J. M. Ellicott, C. P. Eaton.

Given $(x-y)(x^2-4y^2)=2ax^2+10axy+20ay^2+24a^2x$, find the equations to the asymptotes, and to the line which passes through their intersection with the given, trace the curve.

Trace the locus of $(x-2a)(x-a)y^2=a^2x^2$, and of $(xy-12a^2)^2=36a^3(3a-y)$. In the latter, determine the maximum ordinates and abscissas.

Trace the curves $x^4-a^2xy-ay^3=0$, and $x^4+ax^2y-ay^3x=0$; in the latter, find the equation to a tangent parallel to the axis of X .

Trace the curve $2x(x-y)^2-3a(x^2-y^2)+4a^2y=0$.

Find the asymptotes to $x^6-x^4y^2-2a^2xy^3-a^4x^2+3a^5y=0$, and the points where they meet the curve; trace the curve.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

PUNCTUATION.

OCTOBER, 1879.—*Time allowed, two hours.*

Correct and put in capitals in the examination paper
Write out the following forms

1. An indorsement on a report of a survey of the entrance of Chesapeake Bay
2. A report from the Trenton lying in the harbor of Toulon
3. Abbreviations of designation of rank

Give rules for the use of six separate points in the following extract what is the case as a question once put to Marivaux I know nothing of it he answered but that spiritual and immortal well said his friend let us ask Fontenelle he will tell us it is heavens no cried Marivaux ask anybody but Fontenelle

State the rule for the use of points in connection with marks of parenthesis in the following cases (1) when in the absence of a parenthesis no point would be needed (2) in the absence of a parenthesis a comma would be needed (3) when the parenthesis has a point of its own

Give the rules for the punctuation of the following extract what hope can there be for the colonies of nations that possess no spring of improvement and tolerate none over which they rule whose administration sets no bright example of elementary independence whose languages send out no lessons of science literature philosophy but repeat with every ship that crosses the Atlantic the same message basing bigoted and antiquated superstition

ENGLISH.

MONTHLY EXAMINATION.

NOVEMBER, 1880.—*Time allowed, two hours.*

Explain the difference between dialects and languages; between the synthetic and analytic conditions in a language.

"Close likeness to Scandinavian dialects is to be found in northern English, likeness to Frisian dialects in southern English." Explain fully.

Show why inflections are lost in the development of a language; and give a list of the inflections lost by the introduction of Norman French.

Show how the Celtic language influenced English.

"In early times, English literature was local." Explain this, show why it was and how a change came about.

Show how the conquest of the Saxons, Angles, and Jutes differed from the Norman conquest, in the treatment of the conquered race.

Explain the meaning of the following terms: 1. Saxon. 2. England. 3. Norman. 4. Briton. 5. Welsh. 6. Revival of Letters.

ENGLISH AND HISTORY.

JANUARY, 1880.—*Time allowed, four hours.*

[Starred (*) questions are alternatives.]

A.—HISTORY.

1. "The Roman Empire of the West had become a German state." *St* whom, and through what combination of circumstances, this change was a and on what grounds it was justified.

1.* Explain the change that took place in the character of the nation Germany, in the middle ages, and trace the causes that gave it its lat Name the persons with whom rested the selection of the Emperor after century. How did this method of selection differ from the original way King among the Teutonic nations?

2. League of Cambray and Holy League: dates, parties, objects, and r

2.* What country was the battle-field of Europe from 1515 to 1530? the opposing parties in these wars? What advantages had each party a Give the date and place of the most important battle of the period, and mediate results. What were the general results of the whole struggle?

3. What was the first Aryan nation that occupied Western Europe? Wh ist of inhabitants anterior to the coming of this nation? What became Aryan nation? What and where are its present representatives? Wh nations still inhabit Europe?

4. Describe the position of Sparta and Athens, with reference to the res between 305 and 371. Name the battles that took place at these dates, the victorious leader in each, and fix the position of the battle-fields.

Who was Themistocles? Agis? Philopoimen?

5. State the exact position of, and some point of historical importance with, the following, giving dates: 1. Chalons. 2. Nikaia. 3. Crecy. 4 5. Trent. 6. Nancy. 7. Sempach. 8. Trebizond. 9. Habsburg. 10. La

B.—ENGLISH.

6. "The history of the language during these centuries would be the s way in which the speech of the home-dwellers swallowed up that of the n Explain fully this passage; name the dialects introduced by the "new com the principal points in reference to the contest between the two languag dates that fix its beginning and end.

7. Analyze: "In the gardens you will see a solitary laborer, working apathy that characterizes an Irishman when he labors for himself."

8. Analyze: "These waves are to me what the land is to you, for I was b and I have always meant that they should be my grave."

ENGLISH.

MAY, 1880.—*Time allowed, five hours.*

[Starred questions are alternatives.]

1. Name and define the laws of linguistic change, giving an illustration showing from the etymology of the word how the law applies.

1.* How does a novel differ from a romance? In what two ways may t of a work of fiction illustrate character? Apply this distinction to any tw have read.

2. Explain expressed and implied metaphor, and show that the latter is a large part of language.

2.* Give the admissible and inadmissible contractions of *am, are, were, have, has, do, shall*, with pronouns and with the negative *not*.

3. What is induction? What is induction through enumeration? Why is experiment necessary to induction?

3.* Distinguish between essentials and accidents. What is mathematical certainty? Explain *ignoratio elenchi*, and show how to meet it.

4. Explain *epic, idyl, plot, fine writing, syllogism*.

5. Into what errors is a writer most likely to fall in dealing with incidents and characters, in historical composition?

5.* In what kind of composition does argument principally occur, and how should the form of composition modify the handling of the argument?

6. Under what limitations may speech be said to be the guide to written prose?

6.* Name some of the sources of prejudice, and show how it interferes with correct observation and correct inference.

7. Correct and point out the faults in the following:

"He was the universal favorite of all who knew him, and cemented many friendships at this period (moving in the highest circles of society, and, as he had certain property, being independent of the profits of literature), and soon completely extinguished the breath of slander, which, at the inauguration of his career, had threatened to sap the foundations of his reputation."

8. Correct and point out the faults:

"As soon as the man in the plug hat had ventilated his opinions, a panic took a hold of most every person on change. I reckon the market had busted, and some individuals must have lost considerable. I lay down my hat, and just set still and watched. I was sort of curious to know what would transpire."

9. It is stated to you, in conversation, that naval officers fifty years ago wrote books at the age of 30, and that they do not write books now at that age; and from this the speaker infers that the Academy course is defective. On inquiry, you find that he can cite only one case in support of his statement. Point out the errors in the argument, and show in general the danger of this form of reasoning.

"Old friends are best. King James used to call for his old shoes; they were easiest for his feet." Classify and discuss the argument.

10. "As to woman's wages I hold them inferior partly because of her inferior strength, but mainly because of her inferior skill. Nilsson has no cause to complain; and the whortleberries sold in our markets bring no higher price when picked and offered by men, than when offered by women."

Point out the inductive and the deductive parts of this argument. Put the deduction in the form of a syllogism, supply the missing premise, and point out the major and minor premises and the middle term.

N. B.—The proposition, "woman's wages are inferior," is to be taken as the conclusion in the syllogism.

HISTORY OF THE UNITED STATES.

JUNE, 1880.—Time allowed, four hours.

1. Give an account of the Alabama claims, the negotiations connected therewith, and the final settlement.

2. What territory was acquired from Mexico in 1848? Give an account of the measures taken towards its reorganization.

3. Give a brief statement of the financial measures adopted at the beginning of Washington's administration, (1) to provide a revenue, (2) to secure the public credit.

4. Connect the Missouri Compromise with the Kansas-Nebraska act, showing from the provisions of the two acts what they had to do with each other.

5. Explain the terms *patroon, articles of confederation, charter government, representative assembly*.

6. Give a brief account of any three of the following. 1. Nathaniel Bacon. Williams. 3. Daniel Webster. 4. D. G. Farragut.

7. When and how did the Federalists lose control of the government? : circumstances connected with this event, and the political doctrines advocated by different parties.

8. Name the thirteen acts of Parliament that led directly to the revolution. scribe any two of them.

9. Give a brief account of any three of the following. 1. Dred Scott case. bargo of 1807. 3. Ostend manifesto. 4. Louisiana purchase.

10. "American political history is a history of compromises." Show this true, and describe fully the compromise of 1832.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

JUNE, 1880.—Time allowed, three hours.

Translate into French :

1. Good evening, Miss A—. I hope I do not disturb you?
2. No, sir; on the contrary, I am very glad to see you.
3. When did you receive a letter from your brother?
4. I received one last evening.
5. How old is he now?
6. He will be fifteen next May.
7. Will he come home next summer?
8. No, sir; generally the midshipmen make a cruise during the summer.
9. Do they take sailors to help the midshipmen?
10. Yes, sir; because without them they could not work ship.
11. What ports will they visit?
12. They will only go to France this year.
13. Do the midshipmen learn French at the Naval Academy?
14. They are obliged to learn it, because with English and French the sailor can travel everywhere.
15. How long does it take to go to France?
16. I am told that with a good wind it only takes twenty-five days.
17. In that case your brother will come back to the United States about the September.
18. Yes, sir; and then the Admiral will grant the midshipmen a month's visit their homes.
19. I suppose you will be much pleased to see him?
20. We shall be very glad, for it is now a year since he left us.
21. I will do myself the pleasure to call when he returns.

Translate into English :

1. Un officier français étant arrivé à la cour de Vienne, l'impératrice lui demanda, s'il croyait que la princesse de Neuchâtel, qu'il avait vue la veille, était la plus belle femme du monde, comme on le disait. "Madame," répliqua-t-il, "je le croyais hier."

11. Henri IV rencontrant un jour dans son palais un homme qui lui était inconnu, lui demanda à qui il appartenait : "Je m'appartiens à moi-même," répondit-il. "Mon ami," dit le roi, "vous avez un sot maître."

GRAMMAR.

1. How many genders are there in French?
2. How is the gender of nouns denoting living things determined?
3. Give the French articles.
4. When is the euphonic *t* used in French?
5. As a general rule how is the plural formed?
6. Give the possessive adjectives with their masculine, feminine, and plural forms.
7. With what do the possessive adjectives agree?
8. What is the ending of the infinitive of verbs of the first conjugation? Name some of them.
9. When is a noun said to be used in a general sense?
10. What is the English of *vouloir*, *pouvoir*, and *savoir*? To what conjugations do they belong?
11. How many kinds of personal pronouns are there?
12. What is the meaning of *chez*? Give an example.
13. What relation does *en* express? Give an example.
14. When is a noun said to be used in a partitive sense? Give an example.
15. By what preposition is the infinitive limiting an abstract noun preceded?
16. Are *cent* and *mille* preceded by the numeral "*un*"?
17. When are *dans* and *en* to be used? Give an example.
18. What is the French of "*To be*," used impersonally?
19. Give in a table—
 - (a) The present indicative, first person singular and plural.
 - (b) The third person singular and plural of the imperfect.
 - (c) The second person singular and plural of the future.
 - (d) The first and second persons singular and plural of the present subjunctive of *avoir*, *être*, *parler*, *finir*, *aller*, *venir*, and *sortir*.

THIRD CLASS.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

JANUARY, 1880.—Time allowed, four and a half hours.

Without tables.

1. Define the *sine* of an angle, the *tangent* and the *versed sine*; what is meant by the *circular measure* of an angle? What is a *small angle*? How do you find the *sine* or *tangent* of a small angle? How do you take from the tables the functions of $\frac{n\pi}{2} \pm y$?
2. Deduce the formulas for the *sine* and *cosine* of $(x \pm y)$ (full demonstration): find the functions of 30° and 45° , and apply the preceding formulas to find the *sine*, *cosine*, and *tangent* of 15° .
3. Deduce formulas for the *sine*, *cosine*, and *tangent* of $\frac{x}{2}$; find the *sine*, *cosine*, and *tangent* of $7^\circ 30'$ from those of 15° . Show how to solve a right triangle when the *hypotenuse* and one side are given, and are very nearly equal.
4. Deduce the formulas $\sin x + \sin y = \dots$ and $\cos 2x = 1 - 2\sin^2 x$, and apply them to solve the equation, $\sin 9x + \sin 5x + 2\sin^2 x = 1$; express the result, so as to include all angles which satisfy the equation.
5. Prove that in any plane triangle $\frac{\sin A}{\sin B} = \frac{a}{b}$, and $a^2 = b^2 + c^2 - 2bc \cos A$: express each of these results in the form of a theorem. Deduce $\sin^2 \frac{1}{2}A = \dots$ and $\cos^2 \frac{1}{2}A = \dots$
6. In a plane triangle given a , 10; b , 30; C , 60° : find c and $\tan A$; the area of the triangle, and the radii of the inscribed and circumscribed circles.

is in a N. and S. line. The altitude of the sun being π , and required to find an expression for the tangent of the vertical shadow of the pyramid. What must be the angle α , (1) so that be 90° ? (2) so that it may be 60° ?

JANUARY, 1880.—Time allowed, four and a half hours.

Practical work.

[One question may be omitted.]

1. In a plane triangle, given a , 319.49; b , 571.82; C $37^\circ 30'$.
2. Given a , 84.762; b , 102.47; A , $54^\circ 45' 30''$: solve the triangle.
3. Given a , 319.49; b , 571.82; c , 624.41: find the angles, the area, and the radii of the inscribed and circumscribed circles.
4. Given $c = 80.34$, the perpendicular p upon c , 4.631, and the area, 1.713: solve the triangle (See Chauvenet, Art. 164, page 83).
5. To determine the distance between two inaccessible objects, a line of 1,713 yards was measured in the same horizontal plane, and the following angles were observed: BAD , $40^\circ 16'$; BAC , $97^\circ 56'$; ABC , $42^\circ 22'$; and ACD , $51^\circ 54'$. (before beginning the work, draw a figure and state what is required, noting the given and the required parts in each).
6. In a spherical triangle, given A , $135^\circ 30'$; b , $97^\circ 8'$; c , $100^\circ 11'$: find a .
7. Given h , $29^\circ 45' 30''$; d , $18^\circ 30' N.$; L , $45^\circ 32' 30'' N.$: find t .
8. Given h , $44^\circ 57'$; d , $22^\circ 29' S.$; t , $30^\circ 11'$: find L and Z .
9. Given h , 45° ; d , $22^\circ 30' S.$; t , 30° . Make a stereographic projection of the primitive circle on the plane of the equator, radius of primitive circle equal to 1 inch, and find the actual length in inches of that portion of the projection of the primitive circle which is included within the primitive; the small circle being drawn at a polar distance equal to $90^\circ - h$.

DESCRIPTIVE GEOMETRY.

CADET-MIDSHIPMAN.

JUNE 1880.—Time allowed, three hours.

4. Cut a right cylinder by an oblique plane and develop the cylinder and curve. What is the curve? Find its equation, denoting the radius of the cylinder by a , and the inclination of the plane by α .

5. Make a section of a surface of revolution (either an ellipsoid or a hyperboloid) by a plane oblique to H and V and draw a tangent to the curve.

6. A sphere, radius $1''$, has its centre $1''.5$ in front of V and $1''.5$ above H ; a line perpendicular to V passes through a point $1''.5$ to the left of the centre of the sphere. A surface is generated by a straight line which is parallel to V , and constantly touches the sphere and line given above. Construct the projections of the surface, showing the curve of contact with the sphere. Find a section of the surface by a plane parallel to H and $1''.5$ above the centre of the sphere. Find the equation to the surface, and the equation to the horizontal projection of the section, taking the origin at the centre of the sphere.

DESCRIPTIVE GEOMETRY.

CADET-ENGINEERS ONLY.

JUNE, 1880.—Time allowed, four hours.

[One question may be omitted.]

1. Make a right section of a cylinder which stands obliquely to H and V , and has a circular base in H . Find the true form of the section.

2. Cut a hyperbola from a right cone and construct the asymptotes.

3. Pass a plane tangent to a sphere through a given line, the center of the sphere being above H and in front of V , and the line oblique to H and V .

4. Construct the projections of a helix with a vertical axis; prove that the shadow upon H is a cycloid. Construct a tangent to the helix at a given point. Construct a tangent to the cycloid at a given point.

5. Find by means of an auxiliary circle the horizontal trace of a plane tangent to a helicoid at a given point: make use of this method to find the line of shade on a helicoid: give complete explanations and proof.

6. Make a section of a surface of revolution (either ellipsoid, hyperboloid, paraboloid or ring) by a plane oblique to H and V . Explain the method, and draw a tangent to the curve.

7. An inverted frustum of a cone stands on H , radius of lower base $0''.75$, radius of upper base $1''.5$, height $2''$, axis $3''$ in front of V . Find the shade on the surface, and the shadow on the interior and on H ; the horizontal and vertical projections of the rays making angles of 30° and 135° with the ground line respectively.

8. A paraboloid of revolution stands on H , axis vertical and vertex down. Find the line of shade, the shadow on H , and the shadow on the interior surface; rays parallel to V , and inclined to H (30° to 45°).

ANALYTICAL GEOMETRY.

JUNE, 1880.—Time allowed, three hours.

[One question may be omitted.]

1. A line AB cuts intercepts a and b from rectangular coordinate axes; find the equations to the sides of the square described on the line. Find the co-ordinates of the centre of the square. What is the locus of the centre?

2. Deduce the formulas by which rectangular axes are turned through an angle ϕ . Find the co-ordinates of the centre of the conic, $x^2 - 2xy + 4y^2 + 8ax + 26ay + 27a^2 = 0$, and move the origin to that point. What does the equation $(x - y + 3a)^2 = 4ax\sqrt{2} + 6a^2$

become when the axes are turned 45° ? What is represented by t

$$r=c\left\{\sin\theta+\cos\theta\pm\sqrt{\sin 2\theta}\right\}$$

3. Find the equations to the tangent and normal to the parabola in Find the locus of the intersection of perpendicular tangents. Find the intersection of perpendicular normals.

4. Show that in the ellipse the normal bisects the angle between the tangents; and that a perpendicular upon the tangent from a focus, meets upon the circumscribed circle. Find the relation between the direction of conjugate diameters, and show that the eccentric angles of the vertices of the diameters differ by $\frac{\pi}{2}$.

5. Trace the loci of the equations,

$$4y^2-4xy+3x^2+20x-16y-16=0, \text{ and } (2x-y)(2y-x)=4x+4y-$$

6. Find the co-ordinates of the points where the parabola, $y^2=4ax$ is normal, $y=mx-2am-am^2$. Show that the locus of the intersection of the perpendicular upon it from $(9a, 6a)$, taking the origin at the $y^2(x^2+y^2)=a(x+y)(x+2y)(x-3y)$. Trace the curve.

7. Through the point $A(a, 0)$ draw a line meeting the axis of Y at B , a line meeting it at C , so that $OAC=2 OAB$. It is required to find the intersection of AC with the perpendicular upon it from B .

INTEGRAL CALCULUS.

ELECTIVE COURSE.

JUNE, 1880.—Time allowed, four hours.

Cadet-Midshipmen L. Nixon, J. T. Arnold, E. W. Sutphen, and S. S. Wood.
Cadet-Engineers R. W. Gatewood, Emil Theiss, W. H. P. Creighton, and J.

Integrate the following expressions:

1. $\cos^2 \theta d\theta$, $\frac{dx}{a+2bx+cx^2}$ (two cases).

2. $\frac{dx}{\sqrt{(x^2+a^2)}}$, $\frac{dx}{\sqrt{(x-a)(x-b)}}$, $\frac{dx}{\sqrt{(x-a)(b-x)}}$.

3. $\frac{dx}{(a+cx^2)^{\frac{3}{2}}}$, $\frac{d\theta}{\sin \theta}$.

4. $\frac{d\theta}{a+b \cos \theta}$ (two cases).

5. $\sqrt{(a^2-b^2)}dx$, $\sqrt{(2ax-x^2)}dx$, $\frac{dx}{x\sqrt{(2ax-x^2)}}$.

6. $\frac{x^2 dx}{x^4+x^2-2}$.

7. $\frac{(1+x^2)dx}{(1-x^2)\sqrt{(1+x^2+x^4)}}$.

8. Find the whole area of the curves,
 $r=a(1-\cos \theta)$, and $a^2y^4=x^4(a^2-x^2)$.

9. Find the area of the curve,

$$4y^2-4xy+5x^2-16y-32x+52=0.$$

10. Deduce by integration a formula for the volume of the frustum of a cone of its altitude and the radii of its bases. Find the volume generated which revolves about a tangent.

11. Find the volume of an ellipsoid, semi-axes a , b , and c ; and the volume of an elliptic paraboloid, semi-axes of base a and b , and height c .

12. Trace the curve $x^2+y^2=5ax^2y^2$; find the area of the loop, and the area of the infinite branches and the asymptotes.

13. Trace the curve $y^3 + x^2y - xy + bx^2 = 0$, and find the area of the loop.
14. A straight line of constant length, $a\sqrt{2}$, moves with its extremities in contact with two fixed lines which are perpendicular to each other, but not in the same plane; the perpendicular distance between the two fixed lines is a . Find the equation to the surface generated by the moving line, and find the volume included within the surface.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELEMENTARY PHYSICS.

JUNE, 1880.—*Time allowed, four hours.*

[Ten questions required.]

1. Define concisely the terms—mass, weight, density, force, work, dimensional equation, centre of gravity, moment of a force with respect to a point, wave and wave front.
2. Also temperature, coefficient of expansion, specific heat, latent heat, index of refraction, critical angle, principal focus, virtual focus, and conjugate foci.
3. The numerical value of a certain force is 56 when the units of mass, length, and time are a pound, a foot, and a second. What is the numerical value of the same force when the units are a kilogramme, a meter and second?
4. A man rowing at the rate of eight miles per hour wishes to cross, directly, a river which takes him down stream at the rate of 4 miles per hour. What course must he steer?
5. One side of a U tube 3^{cm} in diameter contains 8 kilogrammes of mercury at 20° C. How much alcohol at same temperature in the other side, which is 2^{cm} in diameter, will counterpoise the mercury? What is the relation between the heights of the columns of mercury and alcohol? Sp. gr. of mercury 13.59; coefficient of expansion of mercury .00018; sp. gr. of alcohol .91; coefficient of expansion of alcohol .0012.

The report of a gun is heard 15 seconds after the flash is seen. Required, the distance of the gun, the temp. of the air being 22° C., and the velocity of sound in air at 0° C. 333^m per sec. What is the velocity of sound in a gas that gives with a reed pipe the octave of the note of an open pipe sounded with air?

What will be the volume at 60° C and 820^{mm} of a flexible balloon containing 25 ^{litres} of air at 12° C. and 740^{mm}?

The bathing tank is about 10^m long, 5^m wide, and 1.75^m deep. How much steam must be passed through the pipes to raise the temperature of the water from 4° C. to 40° C., provided steam enters at 100° C. and is discharged as water of temperature 60° C., and provided the weight of the tank is 2,500 kilos. and its specific heat .22?

Prove that a body of clear water is $\frac{1}{2}$ deeper than it appears looking directly down. An eye under water and directed towards the smooth surface sees all outside objects down to the horizon, and at the same time all objects on the bottom. Account for this and the size of the aperture through which all external objects are seen. Index of refraction of water 1.33+.

1. What is the size and position of the image of a flame 2^{cm} high placed 14^{cm} from a concave mirror of 12^{cm} radius?

2. What is the angle of minimum deviation caused by a glass prism whose refracting angle is 60° and index of refraction 1.5?

3. Describe the astatic galvanometer used in the lecture room. If a current flow in the direction of the arrows in the diagram, which end of the astatic system will tend to move up?

DEPARTMENT OF ENGLISH STUDIES, HISTORICAL LAW.

EUROPEAN HISTORY.

MONTHLY EXAMINATION.

OCTOBER, 1879.—*Time allowed, two hours.*

1. "There was a continuous succession between the early and later empire out any break." Show this, tracing the important steps in the successive Augustus and Charles V.

2. Explain the importance of the feudal system in its effects on government in the middle ages.

3. Give an account of the Latin Empire of Constantinople and of the era which it began.

4. Give some account of Popes Julius II, Leo X, Alexander VI, Sixtus V.

5. Give an account of the confession of Augsburg; the battle of Lepanto of the Netherlands.

6. Draw a map of central and western Europe, as settled by the Peace of Westphalia, putting down the boundaries of the principal states, and the following cities—

1. Avignon.	6. Dunkirk.	11. Loire R.	16. Pyrenees.
2. Strassburg.	7. Metz.	12. Lützen.	17. Geneva.
3. Bremen.	8. Augsburg.	13. Paris.	18. Caserta.
4. Rhone R.	9. Orange.	14. Milan.	19. Zürich.
5. Roussillon.	10. Lübeck.	15. Elbe R.	20. London.

EUROPEAN HISTORY.

MONTHLY EXAMINATION.

NOVEMBER, 1879.—*Time allowed, two hours.*

1. Italy, 1859-1861.

2. Explain the causes and results of the war of the Austrian Succession: sides, states engaged, and leaders.

3. Give some account of—1, Thiers; 2, Bernadotte; 3, Duke of Wellington; 4, Isabella of Spain.

4. Show how the abdication of Francis II, in 1806, put an end to the Holy Roman Empire.

5. Give an account of the circumstances that led to the French revolution.

6. Draw a map of central and western Europe at the height of Napoleon's power, putting down—

Amiens,	Pressburg,	1
Trafalgar,	Jena,	2
Leipzig,	Wagram,	3
Elba,	Copenhagen,	4
Ansterlitz,	Malta,	5

and the boundaries of France, Spain, Rhine Confederation, Bavaria, Saxony, Grand Duchy of Warsaw, Westphalia.

CONSTITUTION OF THE UNITED STATES.

MONTHLY EXAMINATION.

DECEMBER, 1879.—*Time allowed, two hours.*

1. Explain bill of attainder, letter of marque, bill of credit, law impairment of contracts, legal tender, bonds and stocks.

2. Explain the methods of voting in Congress, and give the provisions of the Constitution relating to the same.

stitution in regard to recording votes. State briefly the three ways in which a bill may become a law.

3. Who presides in the court of impeachment when the President is tried? Why? What can you say about the disability of the President from discharging his duties in such a case? What is the lightest punishment that a court of impeachment can inflict? The heaviest?

4. Acts have been passed "which are indefensible on the theory of specially enumerated powers, and which can only be sustained on the general doctrine of national sovereignty." Explain fully the theories referred to, giving examples of such acts, and state and explain the constitutional clause referring to the general powers of Congress.

5. Describe the system of national banks, stating the limitations as to circulating notes. Point out its advantages over the old system. How were the State banks compelled to withdraw their circulation? What change was made in the coinage in 1853? Explain excise.

CONSTITUTION OF THE UNITED STATES.

MONTHLY EXAMINATION.

JANUARY, 1880.—*Time allowed, two hours.*

1. State the powers of the President granted by the terms of the Constitution.
2. Explain law and equity, original and appellate jurisdiction, writ of mandamus, indictment.
3. In what does treason consist according to the Constitution? What is necessary to a conviction of this crime? What is provided in the Constitution in regard to the punishment of treason? What is constructive treason?
4. What are the provisions of the Constitution and of the statutes in regard to the surrender of fugitives from justice?
5. State the provisions of the Constitution in regard to the admission of new States; in regard to the government of the Territories. State the cases in which foreign territory has been acquired, and discuss the constitutional power of the government to make such acquisitions.

RHETORIC.

MONTHLY EXAMINATION.

MARCH, 1880.—*Time allowed, two hours.*

[Omit any one you please of the seven questions; the answers to only six of the questions required.]

- I. Name and explain the four facts or processes that form the constituent elements of science.
- II. Explain the importance and bearing of (1) chronology, (2) geography, in the study of history.
- III. Explain the terms "subject world" and "object world," genus and specific difference, rule of parallel construction.
- IV. Distinguish the meaning of the phrases on the contrary, on the other hand, conversely, obversely.
- V. Give Blair's rules for unity.
- VI. "The putting of what is specific and concrete for what is general or abstract is a means of strength." Explain the terms in the above passage, and show by reasoning and by original illustration that the statement is correct.
- VII. Show how it is that many objects and compositions have the power to please after frequent repetition.

RHETORIC.

MONTHLY EXAMINATION.

APRIL, 1880.—*Time allowed, two hours.*

[N. B.—Omit any one of the eight questions you please; the answers to seven only are

I. Distinguish between: (1) Loose sentence and period, (2) Tautology and anancy, (3) Wit and humor, (4) Example and illustration, (5) Description, and exposition. Take three.

II. Explain: (1) Mixed metaphor, (2) Balanced sentence, (3) Illative conclusion, (4) Pointed style, (5) Obverse iteration, (6) Induction, (7) Deduction. Take three.

III. Give the main rules for the structure of the paragraph.

IV. "The proof of a principle indirectly contributes to its exposition."

V. Explain definition by analysis, burden of proof, argumentum ad hominem.

VI. "As in argument, so in oratory, there must be some common ground upon which to stand." Explain the nature of the "common ground" alluded to, and show how it affords data for the orator.

VII. Name and explain the four methods of inductive proof.

VIII. Explain fully what is meant by saying that a composition is in "good form" with reference both to permanent and variable standards.

NAVAL HISTORY.

MAY, 1880.—*Time allowed, four hours.*

[* Starred questions are alternatives.]

I. Explain the offensive and defensive tactics of the galley period. Explain the tactics of the corvus, (2) the dolphin, and name the battles in which they were particularly successful.

I.* Give the names and dates of the battles in which the following were first used: cannon, chain-shot, shell, flag-signals, the technical order of battle of the line, iron armor.

II. Give a brief history of the development of naval guns and their apparatus, including fabrication, locks and sights, carriages, and projectiles.

II.* Name the offensive weapons of modern naval warfare, and give a statement of the relative power and range of each. Name and describe briefly (1) the first iron-plate ship-of-war, (2) the first ship-of-war with screw propeller, (3) the first armored ship-of-war.

III. Give a brief account of any three of the following: Robert Blake, Val de Villeneuve, Earl St. Vincent.

IV. Give an account of the battle of Naupactus.

V. Give a tactical account of the battle of Copenhagen, with a diagram showing the position of adjoining land, the channels, and fleets. State the opposing commanders, and results.

VI. State the relative strength and distribution of the opposing naval forces at the beginning of the Russo-Turkish war of 1877-78, and give a full account of the five torpedo engagements of the war.

VII. Battle of Trafalgar: date, opposing forces and commanders, tactics and results. Draw and describe diagram of battle.

VIII. Battle of Lissa: date, opposing forces and commanders, details of tactics and results. Show that the battle of Lissa represents an epoch in naval warfare.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

JUNE, 1880.—Time allowed, five hours.

Translate into French.

PAU, THE BIRTHPLACE OF HENRY THE FOURTH.

Pau is one of the most interesting cities of the south of France. It lies in one of the most beautiful and fertile countries in Europe, in one of the finest climates; and the city itself is clean and airy. As for the environs of Pau, they are certainly beautiful. The Gave winds through the charming country that surrounds the town. The chief interest of Pau arises from its having been the birthplace of Henry IV, and the castle, which is still to be seen nearly in the same condition in which he left it. The castle of Henry IV is of more ancient date than the town. Pau was founded about the middle of the tenth century. The site of the castle is finely chosen. From its towers, and even from the windows, you discover the whole province of Bearn, certainly one of the most fertile in the world; and the majestic range of the Pyrenees—the background of this rich picture. The cradle of the king is seen in the chamber where he was born.

SHIPWRECK OF PRINCE WILLIAM.

Henry THE FIRST, king of England, and son of William the Conqueror, having been detained in France during three years, was preparing to return to England. On his arrival at the port of Harfleur, a sailor presented himself before him and offered his vessel for the passage across the straits. The king replied that he had already made choice of a vessel, but he would willingly confide to him his son, Prince William, and Princess Adela, with their retinue, which consisted of the lords and ladies of the court, barons and baronesses, knights and other gentlemen, with their wives. The vessel did not depart until the evening, and by the imprudence of the sailors, excited by the wine which the prince had distributed among them, she struck against a rock, and of three hundred persons, men and women, one only, a butcher of Caen, named Bérold, was saved.

FRENCH DICTATION.

Quelques jours après, la gazette annonça que l'empereur était à Paris, et qu'on allait donner le roi de Rome et l'impératrice Marie-Louise. On ne pensait déjà plus à ceux de la Russie, excepté leurs familles. M. Goulden, quand nous étions seuls à travailler, me disait quelquefois : ceux qui sont nos maîtres, et qui disent que Dieu les a mis sur la terre pour faire leur bonheur, pouvaient se figurer, au commencement d'une campagne, les pauvres soldats, les malheureuses mères auxquels ils vont en quelque sorte arracher le cœur aux entrailles pour satisfaire leur orgueil; s'ils pouvaient voir leurs larmes et entendre leurs gémissements au moment où l'on viendra leur dire : Votre enfant est mort vous ne le verrez plus jamais ! Il a péri sous les pieds des chevaux, ou écrasé par un boulet, ou bien dans un hôpital, au loin,—après avoir été découpé,—la fièvre, sans consolation, en vous appelant comme lorsqu'il était petit ! pouvaient se figurer les larmes de ces mères, je crois que pas un seul ne serait assez dur pour continuer. Mais ils ne pensent à rien ; ils croient que les autres n'aiment leurs enfants autant qu'eux ; ils prennent les gens pour des bêtes ! Ils se trompent : tout leur grand génie et toutes leurs grandes idées de gloire ne sont rien, car il

n'y a qu'une chose pour laquelle un peuple doit marcher,—les hommes, les enfants et les vieillards,—c'est quand on attaque notre liberté, comme on meurt ensemble ou l'on gagne ensemble; celui qui reste en arrière est que les autres se battent pour lui . . . la victoire n'est pas pour elle est pour tous, le fils et le père défendent leur famille; s'ils sont vainqueurs, mais ils sont morts pour leurs droits. Voilà Joseph, la seule gloire qu'un homme ne peut se plaindre; toutes les autres sont honteuses, et la gloire n'est pas la gloire d'un homme, c'est la gloire d'une bête sauvage.

GRAMMAR.

1. Give the French of the demonstrative adjectives, *this, that, these*.
2. When is the form *ce* used? and when the form *cet*?
3. Give the French for *which, what*.
4. How many classes of verbs are there in French? How are they named?
5. How is the object of a transitive verb called?
6. When is a noun said to be used in a general sense?
7. When is a noun said to be used in a definite sense?
8. What is the French for "*I like fruit*"? Why is the article used?
9. Two verbs being joined in construction and having the same subject, what mood is the second placed in?
10. When is the *l* or *t* doubled in verbs ending in *cher* and *cter*?
11. What place do the objective pronouns occupy? Is there any difference in their position?
12. How are they placed in regard to each other? What is the French for "*it to us, it to you*"?
13. What is the meaning of *chez*? Give an example.
14. What is the meaning of *devoir* before an infinitive? Give an example.
15. How many primitive parts has a French verb? Name them.
16. When are *dans* and *en* to be used? Give two examples.
17. Which numeral adjectives do the French use for the days of the month?
18. Does the past participle vary in gender and number?
19. With what does it agree? When does the agreement take place?
20. Give the use of the subjunctive mood.

Questions on La Fontaine's fables.

Reading.

Conversation.

Conjugate *faire, lire, plaire, suivre, aller, envoyer*.

ELECTIVE COURSE IN SPANISH.

JUNE, 1880.

Translate into Spanish.

La noblesse d'âme et les héroïques vertus de Gusman étaient si bien connues que même les maures, ses ennemis, l'avaient surnommé le Bon. Ses exploits et son héroïsme éclatèrent surtout à Zarifa qu'il occupait avec une petite garnison lorsque le redoutable Infant Don Juan de Castille qui commandait parvint, à la tête de 5,000 hommes, mettre le siège devant cette place. Trois mois s'étaient écoulés depuis que la ville avait été investie, sans qu'il y eût eu n'importe quel signe d'affaiblissement. Loin de là, tous les assauts furent repoussés, et Don Juan, désespérant de s'en rendre maître par la force, fut obligé de recourir à la voie des négociations. Il fit donc dire à Gusman que si le roi de Castille n'était venu, qu'il ne pouvait espérer de tenir plus longtemps.

supérieure par le nombre de ses troupes, et que l'humanité même lui faisait un devoir de céder, quelque dure et pénible que pût lui paraître cette nécessité. Ces pressantes ouvertures ayant été rejetées, Don Juan eut recours à un autre expédient. Il écrivit à Guzman qu'il consentirait à lever le siège, si la moitié des richesses renfermées dans la ville lui était livrée, Guzman devant rester libre de s'approprier l'autre moitié, si bon lui semblait. La réplique du héros ne se fit pas attendre. Elle était conçue : "La victoire ne s'achète pas ; elle est au plus valeureux." Irrité de ce refus, il résolut, en désespoir de cause, de tenter un dernier moyen, moyen infaillible, il est vrai, mais infaillible selon lui, car le lâche et le méchant ne sauraient juger du courage de l'homme d'honneur. Il avait, en son pouvoir, le fils unique de Guzman, et il s'était chargé, six mois auparavant, de faire transporter au Portugal. Il le fit conduire sous les murs de la ville, et fit dire au père, que si la place ne lui était pas livrée sur le champ, il ferait, sans délai, trancher la tête à son enfant. Lorsque cette menace eut été communiquée à Guzman, il se rendit aux créneaux du fort, d'où il put voir son fils pour la dernière fois, et entendre les gémissements que lui arrachaient les cris de mort qu'il avait sous les yeux. On dit qu'à cette vue, son âme se troubla, et que son visage fut inondé de larmes. Mais refoulant aussitôt ce cri de la nature blessée, il s'écria d'une voix encore émue, mais où perçait la fermeté du héros : "Mon fils bien aimé, montre-toi digne de celui de qui tu tiens la vie, et sache en faire le sacrifice à la patrie ; le déshonneur, dans ce monde, et des supplices éternels dans l'autre, seront le partage du misérable qui va te ravir le jour." Il dit, et le cœur brisé de douleur, il reprit la route qui devait, dans quelques instants, le remettre en possession de cette tendre mère à laquelle il n'était plus possible de déguiser l'affreux événement qui l'atteignait à ce moment-là même. Aux grandes âmes, les grandes épreuves : c'est la loi de Dieu. Guzman devait l'éprouver, mais il était à la hauteur du rôle que ce cruel événement lui prescrivait, et s'il ne lui fut pas donné d'adoucir la douleur de sa fille qui ne pouvait être consolée, parce que son enfant n'était plus, il sut du moins surmonter tout à la fois, ces deux victimes du cruel devoir que l'honneur, non moins que la religion, lui avait imposé. Le soleil s'était couché sur cette scène d'horreur et la nuit descendue des cieux, étendait ses lugubres voiles sur les deux camps ; tous étaient silencieux. Deux êtres seuls ne dormaient point ; une mère que la douleur tenait éveillée et un père disposant tout pour tirer vengeance de l'infame assassin de son fils. La lune blanchissait à peine les bords de l'horizon, que Guzman à la tête de sa petite troupe de héros, pénétrait dans le camp de Don Juan. La valeur, chez eux, suppléant au nombre, la terre fut bientôt couverte des corps morts de leurs ennemis qui surpris, avantés, et ne pouvant se défendre, s'enfuirent honteusement, laissant leur camp au pouvoir des chrétiens. Don Juan échappa au carnage, mais convaincu, trop tard de son honneur, de l'impossibilité de prendre Zarifa, sous un chef tel que Guzman, il leva le siège, et alla porter ailleurs sa honte et sa fureur.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.

CADET-MIDSHIPMEN ONLY.

JUNE, 1880.—*Time allowed, five hours.*

Ship topmast-cap and send up topgallant mast.

Shift topmast-studding-sail boom.

Sketch a topsail ; name the different parts ; describe all the fittings ; reeve the rope ; and make up the sail ready for bending.

Describe in detail, setting and taking in a topmast-studding-sail ; make a sketch of the lead of all the gear.

Describe a triatic stay, and make all preparations for hoisting out the steam engine, stating the duties of the different parts of the ship.

1. Name the different formations of a fleet order of battle in line, natural order, indicating the station of the commander and squadron commanders. Of what is a reserve division composed?
2. Fleet in double column, natural order, form it into triple column.
3. Fleet in columns of vessels abreast by divisions, form it into centre division, natural order.
4. Fleet in column of vessels abreast by divisions, natural order, form it into column of vessels on right division with the same course.
5. Fleet in line, heading N. form it into echelon of vessels in NW. course.
6. Fleet in column of vessels abreast by divisions, by the same order, store its order on the same tack.
7. Change from single column of vessels to column of vessels on the other tack with leading division to leeward.
8. Make signal NW. $\frac{1}{4}$ W.

DEPARTMENT OF ORDNANCE AND ORDNANCE AND ARMOR.

CADET-MIDSHIPMEN ONLY.

JANUARY, 1880.—*Time allowed, four hours.*

1. Describe in detail a turret carriage.
2. Draw and describe the compressor of a turret carriage.
3. Describe the loading, working, and sighting of turret gun.
4. Describe in detail the manufacture and inspection of spiral rifling.
5. Name and explain the two systems of rifling used in the new Parrott and Butler rings.
6. Draw and describe the Schenckle percussion fuze.
7. Draw VIII-inch M. L. S. B. to scale, giving nomenclature of screw of IX-inch S. B. and 100-pounder M. L. R.
8. Describe in detail the manufacture of the Navy time fuze.

still water, and in a seaway, the target being stationary? What parts of a vessel could be aimed at? Describe the sights of an 8-inch M. L. R.

3°. Name and describe the character of the various injuries which may be found in both M. L. and B. L. rifled guns. State causes, places where generally found, seriousness, and steps to be taken in each case.

4. What precautions are to be taken in opening and entering magazines and shell rooms; to keep flooding apparatus in good order; in stowing metallic cartridges, primers, fireworks? Who inspect magazines before powder is received, and to what their inspection directed?

5. State in full detail how powder is stowed in magazines afloat. Describe the arrangements for supplying a battery with cartridges. By what considerations are they controlled? Where should scuttles be placed?

6°. Draw and describe the 8-inch M. L. R. and describe its manufacture.

7. What care is to be taken of bores and breech mechanism of rifled guns in firing, cleaning, and transportation?

8. Give the nomenclature of the S. P. central compressor carriage and slide, and describe the compression gear. Give drawings.

9. Company in line at a halt, wheel and march to the front in column of fours; marching in column of fours, march to the front in line.

10. Battalion in column of fours on the march, form front into line, face to the rear. Battalion in column of fours deploy into close column of divisions on the leading divisions.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.

CADET-MIDSHIPMEN ONLY.

JANUARY, 1880.—Time allowed, four hours.

- Explain the method of determining the right ascension and declination of stars, mentioning the instrument used. What is the error and what is the rate of a clock? What is the equatorial instrument used?

- How should the finder of a meridian circle be set in order to point the telescope at a star whose declination is 10° south, the latitude being 40° north, and the reading for the horizontal point 0° ? How would you construct a vernier to read to $10''$, value of a division of the limb being $10'$?

- Give the principal proofs of the earth's rotation upon its axis. How is twilight caused? How long does it last?

- Explain the equation of time.

- Explain the retrogradation of the moon's nodes. How is the moon's horizontalallax determined? Define altitude and azimuth.

- Give the different kinds of lunar and solar eclipses which may occur. What are the phases of the moon at each? In what part of her orbit must the moon be at the time of an eclipse? Which limb of the moon is first eclipsed? Which limb of the moon? In what direction does the moon's shadow cross the earth? Does a star, when occulted by the moon in its first quarter, disappear behind the bright or dark limb?

- Explain the cause of the tides and of their daily inequality. What are spring and neap tides? How would you determine the establishment of a port?

- Name the bodies of the solar system in the order of their distance from the sun in the order of their size. Give the number of satellites of each. Define right ascension, declination, and hour angle.

- Of what parts is a comet composed? How are comets distinguished and recognized? What are shooting stars? What causes star showers, and when do they occur? Define celestial latitude and longitude.

DEPARTMENT OF PHYSICS AND

HEAT.

JUNE, 1880.—Time allowed, four hours

1. In correcting the barometric height for temperature, is it the coefficient of real expansion of Hg. used? (Give reasons for the answer.) At 758^{mm} at 20° C., what is the corrected reading? Coefficient of expansion of Hg. being .000019; and of Hg. .00018.

2. In a barometer tube the space AB contains saturated vapor of water on surface of mercury at B. What will occur (to the reading) if the tube be slightly lowered? What if the tube be raised? State how the height of the column of mercury will be affected in each case.

3. Define relative humidity. Through U tubes containing sulphuric acid, a cubic meter of air at 15° C. is passed, and weighs 3.95 grains more than before. Required, the relative humidity. Weight of a litre of dry air at 0° and 760^{mm}, 1.2932. Molecular weight of water, 18.016.

4. Deduce and explain Apjohn's formula $f' = f - \frac{d}{87} \times \frac{1}{3}$. Spec. gravity of aqueous vapor .6235. Assume the latent heat of vaporization of water at 996° Fahr.

5. What will be the weight of a litre of moist air at 20° C. and relative humidity being .53. Maximum tension of aqueous vapor at 20° C., 17.54 mm.

6. What substance will transmit the luminous and absorb the heat from the sun? What accomplishes the reverse? What transmission is necessary for the sun's rays to be absorbed by the earth?

7. Make a drawing of Regnault's apparatus for determining the specific heat of a gas. The reservoir of a Regnault's apparatus has a capacity of 100 litres. It is filled with nitrogen at a pressure of 5 atmospheres. It is allowed to flow through the heater and calorimeter until the pressure in the reservoir is 1 atmosphere, when the operation ceases. Temp. of

veloped is equally distributed between the ball and the target, how many degrees C. will the 15 in. ball be raised in temperature? Spec. heat of iron .1138.

10. In the cycle of operations of the theoretical engine, show by a diagram what represents the mechanical equivalent of *Mdv*. Deduce an expression for Carnot's function when a perfect gas is taken. Also in terms of the absolute temperature.

EXTRA.—State the principles of "Conservation of Energy," and "Dissipation of Energy," and point out their bearing upon the possibility of perpetual motion.

DEPARTMENT OF STEAM ENGINEERING.

DESIGNING MACHINERY.

CADET-ENGINEERS ONLY.

JUNE, 1880.—*Time allowed, four hours.*

[Any four of the last eight and any two of the first six questions may be omitted.]

1. The efficiency of a given engine is .1 and of the boiler, .8. The composition of the coal is C 90, H 6, O 4, how much coal must be burned per hour to develop 400 H. P.?

2. Find from indicator card and data on sheet A, considering clearance and recompression, the required weight of feed-water per hour. Density of feed-water, $\frac{1}{32}$.

Density of water in boiler $\frac{11}{32}$. The weight of steam passing through the jacket is $\frac{1}{10}$ that used in the cylinder.

3. From the indicator card and data on sheet B find the H. P. This engine has a friction dynamometer attached, with a weight of 3,050 lbs. on a balanced lever ten feet long. Find what per cent. of the H. P. is wasted in friction.

4. An engine uses dry saturated steam of 63 lbs. per gauge initial pressure, expanding it in a steam jacketed cylinder, without clearance, to a pressure of—3 lbs. per gauge and exhausting it against a back pressure of—11 lbs. per gauge. Piston speed 600 feet per minute. H. P.=200. Find weight of steam used in the cylinder, per hour per H. P., and the area of the piston.

5. A ship makes 10 knots per hour, burning 16 tons of coal per day, and carries 138.24 tons of coal in bunkers: what distance can she make good against a current of 8 knots per hour?

6. Sketch a three-ported slide-valve, without lap or lead, in its proper position when the piston is at half stroke. Also sketch a perfect indicator diagram (giving scale) from a condensing engine using steam of 60 lbs. gauge pressure and cutting off at $\frac{1}{2}$ stroke. Change it by dotted lines to a card from a non-condensing engine using same steam and expansion; also show by broken and dotted lines excessive steam lead and late exhaust. Show atmospheric and zero lines.

7. A pair of bevel wheels, A and B, with axes at right angles, have an angular velocity ratio of $\frac{A}{B} = \frac{5}{3}$. A has 12 teeth, and the diameter of the base of its pitch cone is 4".5. Construct full size at least $1\frac{1}{2}$ teeth of the pattern for the teeth of the larger wheel, using the odontograph, and show section of wheel. Lay off all dimensions to the nearest $\frac{1}{16}$ of an inch.

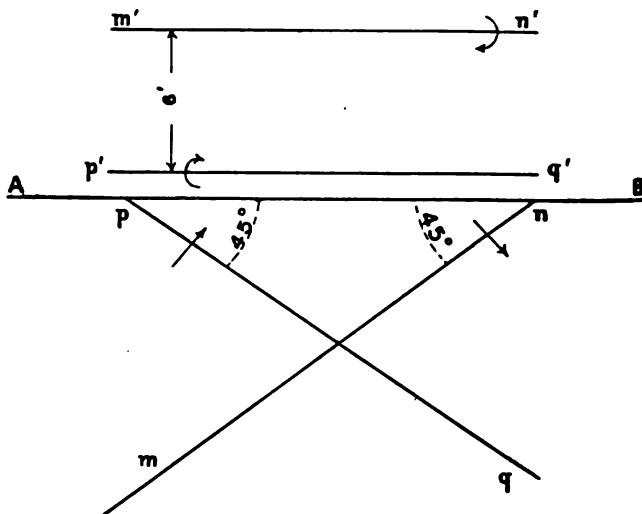
8. A lathe having a countershaft and back gear is driven by a line of shafting, making 100 revolutions per minute. There are to be 12 changes of speed of mandrel, increasing from 4 per minute by a common ratio of 1.5. The sum of the diameters of all opposite pulleys is to be 20". Find and arrange size of all pulleys and train for back gear.

9. A clock having hour, minute, and second hands has 24 coils on barrel, and runs for one day. The pendulum makes $2\frac{1}{2}$ beats per second. The distance between the

axis of barrel and that of the hour and minute hands is $6''.5$, and the diameter of wheels on those axes is $\frac{1}{4}''$. No wheel to exceed 96 and no pinion to have less than 8 leaves. Give the entire notation.

10. A cam revolves once a minute, and gives motion to a rod whose line of action passes through centre of motion of cam. Travel of rod $2''$. The rod rises for $\frac{1}{4}$ of the revolution with a *uniform motion*; remains at rest for 20 seconds; and descends during the remainder of the revolution with an *uniformly-accelerated motion*. Lay down the full size on a base circle of $3''$.

11. The two shafts MN and PQ, connected by a flat endless belt, revolve with ang. veloc. ratio $\frac{MN}{PQ} = \frac{4}{5}$ and the pulley on MN is $20'$ diameter. Give the full size and V projections of the pulleys and belt, giving dimensions.



12. Construct, full size, the necessary mechanism for producing a quick return motion of a sliding piece having a path of $4''$ with a coefficient of friction of $.57735$. The periods of advance = 7, return = 5.

13. Construct the necessary mechanism for showing the motions about the centres of two planets A and B, whose periods are 244 and 100 respectively; the planets to have absolute motion about their own axes.

14. Eccentrics of $4''$ throw and link work, as shown in figure —. How far will point c be from its present position when the centre of eccentric a has arrived at its present position? Neglect angularity of rods and consider points a, b, and c to move in straight paths as shown by red lines.

15. The cross-head of an engine of $4'$ stroke is to be guided by an exact parallel motion, whose fixed centres are respectively $2'$ and $3'$ from the centre line of the cylinder. Construct the mechanism to scale, showing by full lines the position at ends of stroke, and by broken lines at half stroke.

16. A rope ab takes $1\frac{1}{2}$ turns around a pulley A, one end being made fast to a wall and the other carrying a weight W; it is found that with $\frac{1}{2}$ turn of the rope around the pulley a weight of 1 lb. at a will support 2 lbs. at b, a rope c being unwound from the pulley B, and its tension is not to exceed 2,100 lbs.; find weight W.

17. A lathe has 4 threads per inch on a right-handed leading screw; find the least number of change wheels to cut threads (right handed) of $\frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{64}, \frac{1}{128}, \frac{1}{256}, \frac{1}{512}, \frac{1}{1024}$ to the inch. The smallest wheel is to have 20 teeth. Show in tabular form the arrangement of the wheels for the various cuts.

DEPARTMENT OF MECHANICS AND APPLIED
MATHEMATICS.

CALCULUS.

JANUARY, 1880.—Time allowed, four hours.

$$y = \frac{ax-1}{\sqrt{1+x^2}} e^{a \tan^{-1}x}; \text{ find } \frac{dy}{dx}.$$

Deduce $d(\sin x)$.

A vessel sailing due south at the uniform rate of 8 miles per hour is 20 miles north of a vessel sailing due east at the rate of 10 miles per hour; when are the vessels nearest to each other, and at what rate are they approaching each other?

The master of a ship sailing due east at the rate of 8 miles per hour observes a balloon bearing NW; a stone drops from the balloon and strikes the sea at a distance of 1 mile from the ship: having observed the angle of elevation of the balloon, its altitude was found to be 1 mile; if the balloon is rising vertically at the rate of 12 miles per hour, at what rate are the balloon and the ship separating?

Find an expression in terms of its azimuth for the rate at which the altitude of the sun is increasing; and thence show that the rate of increase is greatest when the sun is crossing the prime vertical.

$$\text{Evaluate } \frac{(x-2)(e^x + x + 2)}{x(e^x - 1)^2} \Big|_0^1.$$

The illumination of a plane surface by a luminous point being directly as the sine of the angle of incidence of the rays, and inversely as the square of its distance from the point; find the height at which a bracket-burner must be placed, in order that a point on the floor of a room at the horizontal distance a from the burner, may receive the greatest possible amount of illumination.

It is required to construct from two circular iron plates of radius a a buoy composed of two equal cones having a common base, which shall have the greatest possible volume.

Expand $\log(1 + e^x)$ into a series involving ascending powers of x .

Compute to seven places $\log_e 79$, given $\log_e 3 = 1.098612287$ and $\log_e 5 = 1.6094379124$.

Derive the equation of the rhumb-line, or loxodromic curve, in terms of latitude and longitude.

If earth being regarded as an ellipsoid of revolution, find the radius of curvature of a meridian in terms of the latitude.

$$\int_0^a \frac{dx}{\sqrt{(x^2+a^2)}} \text{ and } \int_a^\infty \frac{dx}{x\sqrt{(a^2+x^2)}}.$$

$$\int_0^\pi \frac{\sin^3 x dx}{\sqrt{(\cos x)}} \text{ and } \int_0^1 \frac{x dx}{(1+x)(1+2x)^2(1+x^2)}.$$

Given $y^2(a-x) = x^3$, determine the area between the curve and its asymptote.

r—

Determine the area enclosed by the curve $r = 2a \cos \theta \cos 2\theta$ between the limits $\theta = 0$ and $-\frac{\pi}{4}$.

4. Determine the length of the curve $r^{\frac{1}{2}} = a^{\frac{1}{2}} \cos \frac{\theta}{4}$, the limits being 0 and 2π .

r—

5. Find the volume included between a right cone, vertical angle $\frac{\pi}{3}$, and a sphere of radius a , which touches it along a circle.

Extra question.

Determine the area of one loop of the curve, $x = 2a \sin \frac{y}{x}$.

Find the least isosceles triangle that can be described about a given ellipse its base parallel to the major axis.

MECHANICS.

JUNE, 1880.—Time allowed, four hours.

1. Two weights, one of which is double the other, are connected by a string which passes over a pulley at the extremity of the horizontal diameter of a fixed vertical circle, the greater weight resting on the concave arc, and the other hanging freely outside the circle; find the position of equilibrium.

2. A weight of 6 lbs. is placed on an inclined plane, the height of which is 4 feet, and the base 4 feet, and is attached by a string to an equal weight hanging over the plane; find how much must be added to the weight on the plane to maintain equilibrium, and determine the pressure on the plane.

3. Find the position of the centre of gravity of the segment of a sphere of given altitude and the radius of its base.

4. A body is supported on a rough inclined plane by a force acting along the plane; supposing the greatest magnitude of the force to be double the least magnitude, find the inclination of the plane to the horizon in terms of the coefficient of friction.

Or—

4. Determine the ratio of the tensions of the two ends of a cord in contact with a rough right circular cylinder.

5. A body is projected vertically upward with a velocity $4g$; after two seconds suppose gravity to cease to act during one second and then to be doubled; find the greatest height to which the body ascends, and the velocity when it returns to the point of projection.

6. A body is projected with the velocity u and strikes at right angles a plane inclined at an angle β to the horizontal; show that the height of the point struck above the horizontal plane through the point of projection is

$$\frac{2u^2}{g} \cdot \frac{\sin^2 \beta}{1 + 3 \sin^2 \beta}.$$

7. Find the moment of inertia of a hemisphere about a tangent at its vertex.

Or—

7. Find the moment of inertia of a right triangle about an axis through its vertex perpendicular to its plane.

8. Find the depth of the centre of fluid pressure on the semi-cardioid $r = a(1 - \cos \theta)$, the initial line being in the surface of the fluid.

Or—

8. A paraboloid generated by the curve $b^{n-1}y = x^n$ is emptied through an orifice at its vertex in one-ninth the time required to empty the circumscribing cylinder; find n and b .

Extra question.

The times of emptying the segment of a sphere through an orifice at its vertex and through an equal orifice in its base are as 2 to 3, the base being horizontal; find the ratio of the volume of the segment to that of the sphere.

Find the ratio of power to pressure in the common vise, allowance being made for friction.

DIFFERENTIAL AND INTEGRAL CALCULUS.

ELECTIVE COURSE.

JANUARY, 1880.—Time allowed, four hours.

Cadet-Midshipmen J. L. Schock, J. H. Linnard, E. Carroll, F. C. Rider, J. L. Rees, J. A. Hoogewerff, T. Serata, J. J. Woodward, W. H. Stayton, H. K. White, and R. B. Dashiell.
Cadet-Engineers J. M. Whitham and G. Kaemmerling.

1. Prove that—

$$(\sin^{-1}x)^2 = 2 \left[\frac{x^2}{2} + \frac{2}{3} \cdot \frac{x^4}{4} + \frac{2 \cdot 4}{3 \cdot 5} \cdot \frac{x^6}{6} + \frac{2 \cdot 4 \cdot 6}{3 \cdot 5 \cdot 7} \cdot \frac{x^8}{8} \cdots \right],$$

and thence derive a convenient series for computing the value of π .2. Expand $\frac{x}{e^x - 1}$, and determine the value of the first two of Bernoulli's numbers.3. Given $x \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$ and $y_0 = a$, expand y in powers of x .Given $y = xe^{-x}$, expand $\sin(x-y)$ in powers of x .4. Prove that $\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$, and thence evaluate $\int_0^\infty e^{-x^2} x^{2n} dx$.5. Prove that $B(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$, and thence determine the value of—

$$\int_0^{\frac{\pi}{2}} (\sin \theta)^{q-1} (\cos \theta)^{p-1} d\theta.$$

6. Given $x^3 + y^3 - 3axy = 0$, find the area between the curve and its asymptote.Find the length of the curve $y = 2a\sqrt{x-x}$, $z = x - \frac{2}{3a}x^{\frac{3}{2}}$.7. Express by means of gamma functions the area and the length of a loop of the curve $r^n = a^n \cos n\theta$.8. The axis of a cylinder whose base is the curve $r = a \cos 3\theta$ passes through the centre of a sphere: find what portion of the sphere is within the cylinder.

Determine the area of a loop of the curve

$$x^2y^2 - 4a^2y + (3a^2 - x^2)^2 = 0.$$

MECHANICS.

ELECTIVE COURSE.

JUNE, 1880.—Time allowed, four hours.

Cadet-Midshipmen J. L. Schock, J. H. Linnard, J. L. Rees, J. J. Woodward, F. C. Rider, J. A. Hoogewerff, T. Serata, H. K. White, E. Carroll, W. H. Stayton.
Cadet-Engineer J. M. Whitham.

1. Deduce an expression for the radius of curvature which is applicable to a curve of double curvature.

Derive expressions for the acceleration along and perpendicular to the normal to the path described by a moving particle.

2. A boat is rowed with a constant velocity u from a point on the bank of a river, and is always directed toward a point exactly opposite on the other bank; if the river flows with a uniform current throughout its width, find the equation of the curve described. Find also the time of crossing the stream.3. A particle moves in a straight line under the action of an attractive force which varies inversely as the n th power of the distance of the particle from a fixed point in the line; determine the time of one oscillation.A particle moves in a straight line under the action of an attraction, varying inversely as the $\frac{1}{2}$ th power of the distance; find the velocity acquired in falling from an infinite distance to the distance a from the centre.

4. A particle acted upon by an attraction va
tance is projected from a given point; determi

5. Determine the friction of a spherical step
lution known as an anti-friction bearing.

6. A particle is acted upon by a central attr
the path described.

A particle is projected from a given point
velocity, and moves under the action of a cen
square of the distance; determine the orbit.

Kepler's pr

7. Given $r = a(1 - e \cos u)$, $\tan \frac{1}{2} \theta = \left(\frac{1 +}{1 -}$

mine r and θ as functions of t .

DEPARTMENT OF MOD

FRENCH

JUNE, 1880.—*Time allowed,*

Translate from Engli

DEPARTURE OF GIL BLAS

Previous to my departure, I went to kiss my
me remonstrances. They exhorted me to be g
honest man, and, above all, not to take the go
benediction, which was the only thing that I
mounted my mule, and went out of the town.

way to Pegnador, master of my actions, a bad
first thing I did was to count and count aga
contain my joy: I had never seen so much mo
at it and handling it. I was counting it, perl
denly my mule stopped in the midst of the high
ened him: I looked, and perceived on the grou
heard a lamentable voice, which uttered these v
on a poor lame soldier; throw, if you please, s
will be rewarded for it in the other world." I
the voice came: I saw at the foot of a bush a
musket with which he was taking aim at me.

I stopped short: I promptly concealed my due
had the precaution to throw them one after th
nobly; he was satisfied with my generosity, an
kicks to my mule in order to get quickly awa
not go faster for that: the long habit which I
under my uncle, had made him lose the use of
adventure too favorable an omen for my journ
not yet at Salamanca, and that I might indee

Translate from Engli

COLIGN

Gaspard de Coligny, Admiral of France, was
time. His name has gained a mournful celebri
greatest martyr in the massacre of St. Bartho
Calvin, and by his austere manners and the pr

which he had embraced. In his youth he was the gay companion of the Duke of No. But the two friends, separated by opinion and by interest, were changed into mortal foes.

DESPERATE PATRIOTISM.

Translate the following into French :

During the wars of Napoleon in Spain, a regiment of the guard of Jerome, ex-King of Westphalia, arrived under the walls of the monastery of Figueiras. The general sent a message to the prior to demand refreshments for his officers and men. The prior replied that the men would find good quarters in the town, but that he and his monks would entertain the general and his staff.

About an hour afterward a plentiful dinner was served ; but the general, knowing from experience how necessary it was for the French to be on their guard when eating and drinking with Spaniards, invited the prior and two of the monks to dine with

him. The invitation was accepted in such a manner as to lull any suspicion ; the monks sat down to table and ate and drank plentifully with their guests, who, after the repast, thanked them heartily for their hospitality, upon which the prior rose and said : " Gentlemen, if you have any worldly affairs to settle, there is no time to lose ; this is the last meal you and I shall take on earth ; in an hour we shall know the secrets of the world to come."

The prior and his two monks had put a deadly poison into the wine in which they had pledged the French officers, and notwithstanding the antidotes immediately given by the doctors, in less than an hour every man, hosts and guests, had ceased to live.

Translate the following into English :

Générosité de Scipion l'Africain.

Un d'hommes ont légué à l'histoire une si belle réputation de pureté et de grandeur que Scipion l'Africain. Son désintéressement et sa magnanimité lui ont valu l'admiration de tous les siècles. Etant parti pour l'Espagne, il prit d'assaut Carthagène le jour même de son arrivée. On lui amena parmi les prisonniers une jeune fille d'une rare beauté. Ayant appris qu'elle était d'une famille distinguée parmi les Celtibériens, et qu'elle était promise en mariage à un jeune prince de ce pays, Scipion fit venir ses parents et le prétendu, et la leur rendit. Les parents de la jeune fille qui avaient été pour la racheter une somme d'or assez considérable, prièrent Scipion de vouloir bien recevoir cet or de leurs mains. Scipion le fit déposer à ses pieds, et ayant appelé le futur, il lui dit : " J'ajoute ce présent de noces à la dot que vous devez recevoir de votre beau-père." En même temps, il exigea que le prince prît l'or et qu'il s'en allât. De retour dans son pays, ce prince, pour témoigner sa reconnaissance à Scipion, fit entrer les Celtibériens dans le parti des Romains.

Dictation.

LA PATRIE.

La patrie, c'est la terre où nous sommes nés, où nous avons grandi, celle qui porte sur elle tout ce qui nous fait notre pain, les vignes d'où coule notre vin, les arbres dont le feuillage nous abrite, les places où nous avons joué, les routes où nos pères ont marché devant nous, et où nous courons à notre tour. La famille, les amis, l'éducation que nous avons reçue, nos plus précieux souvenirs, nos joies, toutes nos affections y sont attachées ; tous ces trésors, c'est la patrie. Elle est la grande famille de ceux qui ont le même langage, la même histoire, les mêmes lois, le même gouvernement, qui ont le même nom.

C'est pour cela que nous devons tous la défendre, l'honorer, l'aimer, la servir. Nous surtout, marins et soldats, que la patrie a chargés du soin de veiller à sa sûreté, de conserver intact l'honneur du drapeau national, servez-la toujours avec

fidélité, avec dévouement, avec amour, suivez l'exemple de tant de braves ont précédés dans votre noble carrière. Comme eux, montrez en toute circonstance courage, le sang-froid, l'énergie que réclame votre état à un si haut degré, joignez à un grand amour de la patrie, la pratique des vertus qui font les illustres et les vaillants hommes de mer.

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

CADET-MIDSHIPMEN ONLY.

JUNE, 1880.—*Time allowed, three hours.*

1. Secure lower yards for hoisting in heavy weights. Describe the tackle and show how they are placed, and how the falls lead.
2. Describe a chain cable; tell how it is made and how marked, and explain manner of getting on board, stowing, and bending to anchor.
3. What is meant by organizing a ship's company? Describe the duties of a executive officer at the time of a ship's going into commission.
4. Ship lying head to wind, get underway under sail, and stand out on the tack.
5. Anchored on a lee shore, get underway and stand off.
6. Set a close-reefed topsail in a gale and describe the method of taking in a gale.
7. Ship being "in irons," show how you would manoeuvre her out of the port.
8. What are the indications of a cyclone? Where and at what seasons do they generally occur? Give rules for managing a ship in a cyclone both in the Northern and in the Southern Hemispheres.
9. Weather main-brace parts when the ship is by the wind: what would you do?
10. If two steamers meet, one steering S.W., the other W. by N., which has the right of way?

SHIP-BUILDING.

JANUARY, 1880.—*Time allowed, four hours.*

WOODEN SHIP-BUILDING.

1. Describe the keel. Show how the lengths are connected, and how they are joined to the stem and stern posts. What is the length of keel scarf, and where do the ribs come? Why? Give elevation and plan sketches.
2. Describe a square frame (long and short arm floors), naming the different parts of which it is built and the manner of uniting them. Describe raising and setting the frame, and show how frames are made to keep their form while being regulated.
3. Describe the different methods of diagonal bracing and state which is most commonly used, and the object of it. Describe the different kinds of ribs.
4. For what purpose is the main keelson worked? What fastenings are used through it? What are sister keelsons? Describe how they are worked. Show their length and show how they are fastened.
5. Describe the preparations necessary to get a ship ready for launching. How is the ship launched, and how do you prevent hogging? Name the different kinds of blocks in use.

IRON SHIP-BUILDING.

Name and describe the different systems of framing used in iron ship building. At keel is generally used with each system? Describe the bar keel and show how connected with the remainder of the hull.

Make a sketch of stem of armor-clad vessels and describe it. When in two or more parts, show how the parts are united and how the stem is joined to the keel.

How are the frames behind armor spaced, and how worked? How do you work ring, girders, and backing behind armor? How do you work armor and armor-plate? Describe armor bolts and method of testing them.

Explain how water-tight bulkheads are fitted. Make a sketch showing the present methods of working outside plating, and describe each.

What is the object of the composite system of building vessels? Name and describe the different methods and illustrate the best.

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE AND ARMOR.

CADET-MIDSHIPMEN ONLY.

JANUARY, 1880.—*Time allowed, five hours.*

Cast iron. Describe the varieties, and show how it is obtained. Express briefly reactions of the blast furnace. State the conditions of fuel and blast required for founding.

Define steel. State the most important processes of making steel, and the essential principles of each. Describe the Siemens-Martens process. Describe the method of tempering steel in oil.

Describe the fabrication of the XV-inch gun, under the following heads: Furnace, charge, mold, core, casting, marking.

Describe the 80-pounder B. L. R., conversion, slotted screw, screw box, gas check.

Draw the VIII-inch M. L. R., giving nomenclature.

Name and explain the two general methods of equalizing the strains in a gun, give the methods of application. Describe in detail the breech mechanism of a breech-loading gun.

Define elasticity, ductility, permanent set, tensile strength, density. Compare cast wrought iron, steel, and bronze, in respect to strength, uniformity, elasticity, ductility.

[6a and 6b are alternatives.]

ORDNANCE AND ARMOR.

CADET-MIDSHIPMEN ONLY.

JUNE, 1880.—*Time allowed, five hours.*

Describe the systems of rifling in use in the United States Navy, and state the advantages and disadvantages of each system.

Draw and give nomenclature of the S. P. central compressor carriage; give rate drawing and describe fully the working of compressor gear.

Describe, with drawings, circular-brake directing bar carriage.

Define explosive effect, state briefly upon what it depends, and discuss fully, giving instances, and showing how such effect is modified by varying circumstances.

What is progressive powder? What has led to the use of progressive powders? What results as regards gun and projectile are sought to be thus obtained? Show

graphically and explain the differing results from the same amount of gas from different powders. What conditions of powder favor progressiveness?

6. How, and of what material, are cartridge bags made? How are they used? Describe the Boremann fuze? When is it used?

7. How are shell, common and battering, and shrapnel filled and fuzed?

8. By what methods may the distance of an object at sea be determined? (but do not describe.) Describe the Boulengé telemeter.

The following questions are not required, but additional credit will be given for each one so far as it is answered.

9. Draw and describe the carriage for the 80 and 100 ton English and Italian guns. What is dynamite, and what are its properties?

10. What is gun cotton? Describe its manufacture, properties, and mode of use.

11. Concentrate a battery of 12 guns on the midship gun, abeam, 500 yards. Describe the arrangements for electrical firing under such circumstances.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

NAVIGATION.

CADET-MIDSHIPMEN ONLY.

JANUARY, 1880.—Time allowed, five hours.

1. In an ordinary day's work by dead reckoning, what sailings are involved? how are they involved?

2. A vessel leaves port at 1 p. m. on a given day: how will you find her position by dead reckoning at noon on the following day? Find the course and distance: is the current good, and the current. (Give the details of the entire work, particularly as to the use of the traverse table.)

3. Deduce the expression for the meridional parts of the spheroid: given—

$$r = \frac{a \cos L}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}}, \text{ and } R = \frac{a (1 - e^2)}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}}.$$

4. How will you construct a Mercator's chart, to extend from latitude 45° S. to latitude 50° N., and to cover twenty degrees of longitude, fifteen inches being used for the space in latitude?

5. How do you find the Mercator's course and distance between two points by inspection of the tables, and upon the chart?

6. Deduce by Napier's rules the formulas for finding the course and distance between two points by great circle sailing? How are the latitude and longitude of the points found?

7. How is the great circle route laid down upon the chart? What advantages does a knowledge of this route give, and what determines the advisability of using it? What is a compound great circle route? How is it laid down and followed?

8. Give one practical method for the conversion of local sidereal time into mean time and the reverse, with reasons therefor.

9. Deduce the formula for finding the hour angle of a body when on or near the prime vertical. When will it be useful to know the hour angle? Deduce the formula for finding the hour angle of a body when in the horizon. How is the time of sunset determined (disappearance of the sun's upper limb below the horizon)?

10. Deduce by Napier's rules the formulas for finding the latitude by an observation of a heavenly body taken at any time. How are ϕ and ϕ' marked respectively? why? When may this problem be used at sea?

11. Deduce by Napier's rules the formulas for finding the azimuth of a heavenly body at a given place and time. How is the t of this problem found in the case of a star? Of what use is a knowledge of the azimuth?

1. Deduce the formula for finding the latitude from an altitude of the sun observed near noon. State how the operation is performed practically, especially with regard to obtaining the value of t which is used.
2. Deduce the equation of equal altitudes. State what quantities are involved in equation, and how each one is obtained.
3. Apply (13) to finding the chronometer correction on Greenwich mean time, giving each step and the reasons in detail.
4. Define circle of equal altitudes and illustrate by a diagram. How may the position of the centre of this circle be found? What is a line of position? Of what use is a single line of position? How can you obtain the azimuth from it?
5. Give in detail the method of finding the latitude and longitude of a vessel at sea by Sumner's method, when the vessel is under way in the interval between the observations.
6. What method would you select for obtaining the latitude and longitude at the same time? Give reasons for your preference. What is the most favorable position for observing a heavenly body for the determination of longitude? of latitude? Give the reasons in each case. How do you find the true amplitude of a heavenly body? Of what use is knowledge of the amplitude?
7. What is the distinction between the *error* and the *correction* of a chronometer? Which is generally used? How is the *rate* of a chronometer obtained? Which method do you consider the best for determining the error of a chronometer? Give reasons for your preference. What is the object of the daily comparison of chronometers? What is the meaning of the term *second differences*, in this connection?
8. Of what use are lunars? How much reliance can be placed upon the results obtained from lunar observations? Draw the figure and explain the method of finding the true distance from the observed lunar distance (formula not required). Suppose the chronometer is injured, how can you find the longitude by lunars?
9. How is the longitude found by a time-sight of the moon? How do you obtain the longitude which is entered in the log-book as the longitude at meridian?

Extra questions.

- * credit will be given for answers to these questions unless all the regular questions are attempted.)
- Deduce the formulas for finding the latitude by two altitudes of the sun, the declination remaining unchanged.
- Deduce Bradley's formula for refraction.
- Deduce the formulas of Chauvenet's method of finding the latitude from the difference of altitudes of the sun near the meridian.

SURVEYING, AND COMPASS DEVIATIONS.

CADET-MIDSHIPMEN ONLY.

JUNE, 1880.—Time allowed, five hours.

- Describe the adjustments and observations necessary to ascertain and correct the systematic error of a bureau theodolite.
- How do you determine the azimuth of a base line? How do you plot the base line and the principal stations on a chart?
- How do you run a single line of soundings? How are soundings reduced and corrected?
- With what instruments and how are tidal observations made, and what information is obtained from them? Describe a bench-mark and its use.
- Describe current observations. Using the tidal observations for comparison, state the rule for computing the drift for spring-tides or neaps from a short series of current observations.
- Explain the method of making a running survey.

7. Give a definition of the polyconic projection. Deduce the general equation of a meridian, and explain fully by diagrams all the quantities involved.

8. How do you construct a scale of $\pi R \sin \theta$ in order that the least count shall be meters? How do you construct a polyconic chart of large area?

9. Define true, magnetic, and compass bearings. How do you find the correct magnetic bearing of an object? How is deviation of the compass marked? How is deviation applied to a magnetic bearing to find the compass bearing?

10. What is a deviation table, and how are the data for constructing it obtained? Explain the method of constructing a deviation table at sea. What is a Napier's diagram, and what is its use? How would you construct a table that would answer the same purpose?

11. Wherein does the deviation of the compass in an iron vessel differ from that in a wooden vessel? What is meant by semi-circular, and what by quadrantal deviation? What are neutral points, and where are the neutral points of each part of a vessel?

12. What is "hard" and what is "soft" iron? Which part of the vessel is most affected by the magnetism of the hard iron? Which part of the soft iron is most affected? What is semi-circular, and which quadrantal deviation?

13. Explain by a diagram of nine soft iron rods the effect of the soft iron on the compass. Give the reasons for the algebraic signs of the rods e and c .

14. Give the three general equations of Poisson, and explain each term of each equation.

15. In the general equation

$$\delta = A + B \sin \zeta + C \cos \zeta + D \sin 2\zeta + E \cos 2\zeta,$$

which are the changing and which the permanent coefficients, and why?

Given $D = \frac{1}{2} \frac{a - c}{\lambda}$, show how D can be corrected mechanically.

16. What causes the heeling error in an iron vessel? How is the needle affected by heeling when in northern latitude, and why? How do you correct the compass for heeling error?

PRACTICAL NAVIGATION.

CADET-MIDSHIPMEN ONLY.

Time allowed, four hours.

1. September 5, 1880, took departure, from Sugar Loaf, in Lat. $22^{\circ} 56'$ S., Long. $69^{\circ} 09'$ W. bearing p. c. WNW. $\frac{1}{2}$ W. and distant 20 miles, the ship's head being so that the deviation on that heading $\frac{1}{2}$ point E. Variation from the chart, $\frac{1}{2}$ point E. Thence sailed till noon, September 6, 1880, as follows:

Compass courses.	Knots.	Wind.	Lee-way.	Deviation.
ENE. $\frac{1}{2}$ E.	22	Nd. and Wd.	None.	$\frac{1}{2}$ pt. E.
E. by S.	24	do.	do.	$\frac{1}{2}$ pt. E.
SE. by E.	24	do.	do.	do.
E. $\frac{1}{2}$ S.	40	do.	do.	$\frac{1}{2}$ pt. E.
S. by E. $\frac{1}{2}$ E.	18	do.	$\frac{1}{2}$ pt.	$\frac{1}{2}$ pt. E.
NNE. $\frac{1}{2}$ E.	72	do.	$\frac{1}{2}$ pt.	do.
NNE.	22	do.	$\frac{1}{2}$ pt.	do.

* Run to noon September 6, from hour of morning time-sight.

Required, Lat. and Long. by D. R. at noon, September 6, 1880, also the correct distance by D. R. from the Sugar Loaf.

At noon, September 6, 1880, Obs. merid. alt. sun's lower limb $61^{\circ} 38' 0''$. Lat. $2^{\circ} 0'$. Height of eye, 21 feet. Required, the latitude.

2. September 6, 1880, about 8 a. m. W. T. obs. $7^h 08^m 21^s$, C—W $3^h 09^m 40^s$, c. c. $+ 0^h 14^m 0^s$. Obs. alt. sun's lower limb $22^\circ 35' 0''$. In. cor. $+ 2' 0''$. Height of eye, 21 feet. Bearing of sun by compass N. 63° E. Ship's head, NE. by N., and the deviation at that point, 5° E.

Required, the longitude at noon, September 6, 1880, variation of the compass, set (in degrees) and drift of the current.

3. Find the time of a. m. high water at Cork, in Lat. 52° N, Long. 8° W, on the 10th May, 1880, the establishment of the port being $4^h 37^m$. Which is the higher, the a. m. or the p. m. tide of that day, and why?

4. June 4, 1880. Compute the local mean time of the apparent setting of the sun's upper limb at Annapolis, Lat. $38^\circ 58' 53''$ N, Long. $5^h 5^m 56^s$ W, supposing the time for the sun to pass through altitude, equal to ref. + dip. + semid., to be $5^m 0^s$.

5. At Annapolis, about 8 a. m. May 4, 1880. Chro. T. obs. $8^h 31^m 22^s$, c. c. $+ 4^h 36^m 15^s$. Angle between sun's nearest limb and a chimney, right of sun, $69^\circ 54' 20''$. In. cor. $5' 40''$. The altitude of the chimney (by the same sextant) above the shore line $10^\circ 21' 30''$. Distance of the shore line, under the chimney, from the observer, 3,300 feet. Height of eye, 29 feet. Required, the true bearing of the chimney.

6. December 16, 1880, in Long. $2^\circ 40'$ W. about 7 p. m. Chro. T. obs. $6^h 57^m 0^s$, c. c. $+ 1^h 10^m 30^s$. Obs. alt. star α Pegasi (Markab) $38^\circ 14' 0''$ bearing NW nearly. In. cor. $+ 2' 0''$. Height of eye, 18 feet. Required, the latitude, by the ϕ' method.

7. Each cadet midshipman will take observations of the sun by sextant and artificial horizon, and compute the error of the chronometer on Greenwich mean time.

[Questions 4 and 5 may be omitted.]

DEPARTMENT OF STEAM ENGINEERING.

MARINE ENGINES.

CADET-MIDSHIPMEN ONLY.

JUNE, 1880.—Time allowed, five hours.

1. Given an engine whose piston is 40 inches in diameter and whose stroke is 4 feet; starting off at $\frac{1}{4}$ from commencement of stroke; clearance $\frac{1}{16}$ of piston displacement per stroke; steam pressure 30 pounds per sq. inch per gauge; vacuum 26 inches barometer at 30; revolutions 50 per minute; relative volume of steam and water at initial pressure 610:1; coal consumed per hour 1,831.25 lbs.; weight of cubic foot of fresh water 62.5 lbs.; $\log_e 1.27 = .239$; $\log_e 1.28 = .2469$; $\log_e 1.29 = .2546$; $\log_e 1.30 = .2624$. Required the mean effective pressure and the number of pounds of water evaporated per pound of coal.

2. Sketch and describe the Wabash, or Meyer valve, and explain the principal peculiarities of the Waddell valve. What is the advantage of the double ported slide valve over the single ported?

3. Water enters the boiler at a density of $\frac{1}{2}$ and is maintained at 2; temperature of water entering is the same as the temperature of the condenser, 103° F.; vacuum 10 inches; compare the economic performance of the engine under these circumstances with the same engine, densities remaining the same, but the water in the condenser (cold water) having a temperature of 135° , and corresponding pressure 2.5 lbs. per inch; the mean pressure of steam being 25.46 lbs. per sq. inch, and the corresponding temperature 241° F.

4. Given the thrust T of a screw propeller, to deduce the formula for the diameter of the shaft to resist torsion due to T, and solve the following.

Example:—Diameter of propeller 16 feet; pitch 20 feet; I. H. P., 1000; speed of ship 10 knots (knot = 6082 ft.); slip 15 per cent. of speed of propeller; coefficient of metal 100 sq. inch of cross-section for a leverage of one foot, 120.

R N A E

6. Deduce the expression for the leverage of friction for a collar thrust. Required, the H. P. necessary to turn a shaft in a collar thrust bearing, the thrust being 50,000 lbs., revolutions per min., 70. Radii of collars, 13" and 10". Coef. of friction, 0.05.
7. Sketch a Bourdon pressure gauge and demonstrate its action.
8. Required, the lbs. of water evaporated from 1 sq. ft. of tube surface and also from one sq. ft. of crown sheet, considering the rate of conduction to be as the square of the difference of temperatures $a=180$. Temp. feedwater, 100° . Of furnace, 2400° . Gases in tubes, 800° . Pressure of steam, 60 lbs. per gauge.
9. Sketch and describe Joule's proposed air engine. Construct cards from a pump cylinder using the same scales for each. Strokes being the same, and the working temperatures being 70° and 600° .
10. Required, the lbs. of water evaporated per lb. of coal from data given on the indicator card on sheet "B."

Available heat of 1 lb. of coal = 6,000,000 ft. lbs.

$$\tau = 1 + \left\{ \sqrt{\left(\frac{A - \log p}{C} + \frac{B^2}{4C^2} \right)} - \frac{B}{2C} \right\}$$

For water $\left\{ \begin{array}{l} A = 8.2591, \log B = 3.43642, \log C = 5.59873, \\ \frac{B}{2C} = 0.003441, \frac{B^2}{4C^2} = 0.00001184. \end{array} \right.$

Answers required to the first five questions and to any other three questions.

DESIGNING MACHINERY.

CADET-ENGINEERS ONLY.

JUNE, 1880.—Time allowed, five hours.

Determine by the method of augmented surface the I. H. P. necessary to drive a vessel of the following dimensions at a speed of 12 knots per hour: length on L. W. 55'; mean immersed girth, 60'; sines of angles of greatest obliquity of water lines, $\sin 1^{\circ} = 0$, 1st = .1, 2d = .2, 3d = .3, 4th = .4; coefficient of propulsion 20000. Also determine the I. H. P. for same vessel by Froude's law of comparison. Dimensions of model $\frac{1}{10}$ of those of vessel; resistance of model at a speed of 200 feet per minute, 6 lbs.; (consider knot as 6,000'); power utilized in propulsion 40 % of H. P.

Determine the diameter, inside length (between heads), and thickness of cylinder for a pair of non-condensing engines to develop 350 H. P. Revolutions per min., 30; stroke, 3'; boiler pressure per gauge, 63 lbs.; steam cut off at $10''$; back pres. 2 lbs. per sq. in. atm.; clearance 12.5 % of stroke displacement; exhaust closes $9''$ from end of stroke; $p \propto v^{-1}$.

Pair of simple condensing engines; diam. of cylinder, $50''$; stroke of piston, $42''$; boiler pressure per gauge, 37 lbs.; vacuum, $24''$; revolutions per minute, 55; cut-off at $10''$ stroke, neglect clearance; $p \propto v^{-1}$; required, diameter of single piston-rod and length of crank-pin. Deduce the formula for length of crank-pin and show that the resistance to heating is independent of the diameter. Wrought iron $f = 36000$ for direct crushing, crank-pins ultimate strength $d = .04554 \sqrt{Apl}$; for deflection, $d = .0707 \sqrt{Ap^2}$; work per sq. in. of pin, 50000 inch units; coefficient of friction .05.

Make torsion diagram for line shaft for question 3 and determine diameter of shaft using data from diagram. Cranks being placed at right angles; scale of pressure 1 lb. = $1''$; and $f = 54000$ for wrought iron.

Design a three-ported slide-valve for engine of question 3 (by a Zeuner diagram) with cut-off at $\frac{1}{4}$ stroke, steam-valve opens when piston is $1''$ from end of stroke, exhaust; closes $8''$ from end of stroke. Required, in inches, opening of steam-port; steam-lap; exhaust-lap; and exhaust-lead; mark dimensions on the lines measured.

Show angle between eccentric and crank, and give distance in inches of the from end of stroke when exhaust-valve opens; give scale for eccentric throw for crank circle $\frac{1}{4}$.

6. Design a Meyer expansion valve (by Zeuner diagram), throw of eccentric, of steam-valve, 2"; angular advance of main eccentric, 30° ; limits of cut-off, $\frac{1}{4}$ and point of cut-off of main valve; throw of cut-off eccentric, same as main eccentric. Give approximate angular advance of cut-off eccentric, and mark its relative position that of the main eccentric, and of the crank; maximum distance the centres of and main valves will be apart; distance the cut-off blocks will be apart when off at $\frac{1}{4}$ and $\frac{3}{4}$ stroke; and the width of cut-off blocks.

7. Compound condensing marine engine of 500 I. H. P., using 20 pounds of steam I. H. P. at a pressure of 80 pounds per gauge. Design boilers to furnish steam for engine, and to burn anthracite coal by natural draught.

Required, number, diameter, and length of boilers; thickness of shell and riveting; number, size, and arrangement of furnaces; total grate surface, heating face, and calorimeter through tubes and at uptake; diameter of tubes and space for each boiler, and total steam space.

8. From diagram (sheet B) calculate requisite condensing surface and diameter of single-acting feed-pump of same stroke as engine. Sketch and describe See Allen's, and Stimers methods of packing condenser-tubes.

9. Required, the length, depth, and number of buckets for a radial paddle also the greatest dip, to drive a vessel 11.15 knots per hour, the resistance at speed being 20,000 lbs., slip of outer edge of paddles 30 % of speed of vessel, and wheels to make 18 revolutions per minute.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

STRENGTH OF MATERIALS.

CADET-ENGINEERS ONLY.

JANUARY, 1880.—Time allowed, four hours.

1. Having given the angles which three conjugate stresses make with one another, determine the obliquities of those stresses, and the angles between the normal to their planes of action.

2. Derive the general differential equations for the internal equilibrium of a beam.

3. Find the stresses on the parts of a half-lattice girder, uniformly loaded at its ends.

4 and 5. In an isotropic substance, find the coefficients of transverse elasticity of elasticity of volume in terms of the coefficients of direct and lateral elasticity; coefficients of transverse pliability and of cubic compressibility in terms of the coefficients of direct and lateral pliability; the coefficients of direct and lateral elasticity in terms of the coefficients of direct and lateral pliability; and the coefficients of transverse pliability in terms of the coefficients of direct and lateral elasticity.

6. Find the pressure on the right-hand support, the abscissa of the point of greatest deflection, and that of the point of greatest deflection in a given uniform beam, fixed at the left-hand end, supported at the right-hand end, and loaded with the weight W at its middle point.

7. Find the proper diameter of a cylindrical shaft in terms of the moment of inertia and of the working shearing stress of the materials of the shaft.

8. Deduce the differential equations between the dynamic head in a fluid at rest and motion in the direction of three rectangular axes, and prove that for steady motion

$$\frac{v^2}{2g} + h = \text{constant}.$$

THE METHOD OF LEAST SQUARES.

MONTHLY EXAMINATION: CADET-ENGINEERS ONLY.

FEBRUARY, 1880.—Time allowed, two hours.

1. Prove that for direct observations the equation to the probability curve is $y = ce^{-a^2x^2}$. Determine the value of c .

2. Deduce the formula for the probable error in the value of a quantity determined by n direct observations.

Five measurements of a base line are as follows: 342.56, 342.47, 342.45, 342.60, and 342.58 meters; determine the length of the base line, and the probable error of this determination.

3. Having measured the following angles, $AOB = 15^\circ 16' 25''$, $BOC = 16^\circ 15' 30''$, $AOC = 31^\circ 32' 00''$, $COD = 17^\circ 25' 10''$, and $BOD = 33^\circ 40' 50''$, determine the most probable values of AOE , BOC , and COD when the observations are of equal weight; also determine the values of the same angles when the weights of the measurements are 1, 2, 3, 4, and 5 taken in the order of measurement.

4. Having given sixteen observations of the form . . .

$$M_1 = s + t \sin a + u \cos a + v \sin 2a + x \cos 2a$$

$$M_2 = s + t \sin 2a + u \cos 2a + v \sin 4a + x \cos 4a$$

$$M_3 = s + t \sin 3a + u \cos 3a + v \sin 6a + x \cos 6a$$

&c.

&c.

&c.

where $a = \frac{\pi}{8}$;

determine the most probable values of s , t , and x .

5. Having measured the four angles of a quadrilateral, $x = 95^\circ 38' 12''$, weight 4, $z = 116^\circ 1' 40''$, weight 6, $u = 34^\circ 20' 18''$, weight 8, and $v = 63^\circ 59' 20''$, weight 5; determine the most probable values of the angles.

THEORETICAL NAVAL ARCHITECTURE (ELECTIVE).

JUNE, 1880.—Time allowed, three hours.

Cadet-Midshipmen P. B. Alger, J. B. Bernadou, H. G. Dresel, L. S. Norton, H. Phelps, W. Truxtun, A. A. Ackerman, A. R. Howze, G. E. West.

1. Derive Woolley's rule for determining volumes.

Having given three equidistant ordinates, derive a formula for computing the area between two of the ordinates in terms of the three ordinates.

2. Derive Simpson's *one-third rule*, and show when it is exact and when approximate. Determine by means of this rule the centre of gravity of a hemisphere. Show how this rule may be applied to half and quarter intervals.

Determine the angle of maximum efficiency of a rudder when the power applied is limited.

3. Show that the curve of intersection of a plane perpendicular to the axis of a wave, with a wave surface of uniform pressure, is a prolate cycloid.

Determine the height of the longitudinal metacentre of a ship.

4. Derive the formula for computing the augmented surface, and show how it may be applied to determine the probable speed of a ship when the power of the engines is known.

5. Derive Weddle's rule for quadratures.

THEORETICAL NAVAL ARCHITECTURE (ELECTIVE).

JUNE, 1880.—Time allowed, three hours.

Cadet-Engineers W. F. Durand, A. W. Stahl, W. S. Sample, W. F. C. Hasson, H. Hall, A. T. Woods, L. D. Miner, W. H. Allderice, C. A. King, J. L. Wood.

1. Deduce Weddle's rule for quadratures by the method of finite differences.

2. Deduce Woolley's rule for moments, and find the centre of gravity of a hemisphere by Simpson's first rule and the volume by the five-eighth rule.

3. Deduce the expression for the height of the longitudinal metacentre of a ship, and arrange the work for its computation.

4. Arrange the work for the computation of the statical and the dynamical stabilities of a ship at a given angle of heel, using only one intermediate section.

5. Having given the equivalent girder of a ship and the following data, find the greatest thrust and tension, supposing the girder to consist of an upper and lower web and three flanges, the distance between the upper and middle flanges being the distance between the middle and lower flanges 12'. Area of upper flange, 100 sq. in. Area of upper web, 120 sq. in. Area of middle flange, 130 sq. in. Area of middle web, 300 sq. in. Area of lower flange, 500 sq. in. Displacement, 1500 tons. Length, 200 feet.

Having given, as the result of experiments, that the radius of the orbits of the surface particles of water does not exceed one-fourth the length of the simple pendulum whose time of oscillation equals that of the waves, show that the greatest increase of weight caused by the motion of the ship does not exceed one-fourth of itself.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

INTERNATIONAL LAW.

JUNE, 1880.—*Time allowed, five hours.*

[* Starred questions are alternatives.]

I. Name the ship's papers required by international law. Describe any two of them.

II. State the extent of the responsibility of a neutral government for acts of its subjects, (1) engaged in contraband trade, (2) building or equipping ships of war for the use of a belligerent; and explain the grounds of the distinction. State the provisions of the treaty of Washington bearing on this question.

II.* "When an internal war breaks out, the government must determine whether the municipal or the international code, in whole or in part, shall be adopted. Explain what is meant by the two "codes," give the reasons for the adoption of one, and the consequences flowing from it.

III. State the rules adopted by the British Government, in 1861, in regard to the prizes of the belligerents in its ports, and in regard to supplies of coal to belligerent steamers; and the rules adopted in 1854 in regard to enemies' vessels in the case of the outbreak of war, and in regard to enemies' property in neutral vessels.

III.* State the extent of exemption from local jurisdiction in foreign ports of (1) vessels of war, (2) merchantmen, (3) the crews of public and private vessels. What is the law in France on this subject?

IV. Define the right of search, stating when, by whom, upon whom, and in what manner, it is to be exercised, and to what extent the search may or should be extended. What is the penalty for resistance to search?

IV.* Discuss the right of convoy, giving the leading cases on the subject, and stating the general tendency of present usage.

V. Define (1) international law, (2) municipal law, (3) exequatur, (4) prescription, (5) embargo, (6) postliminy. Explain the difference between a domiciled foreigner and a foreigner that has been naturalized.

VI. What is the modern usage as to the treatment of irregular soldiers during war? as to capture of enemy's private property on land? as to capture of private property on land? What is the usage as to requisitions?

VII. Classify the various kinds of contraband goods. How far is the destination of the goods a test of their contraband character? Discuss the doctrine of *absolute contraband*.

VII.* How long does liability for a breach of blockade continue? What circumstances constitute the cessation of a blockade? Discuss the doctrine of *continuous voyages* as applied by the Supreme Court in the war of 1861-5.

VIII. A cruiser seizes at sea, for a cause that the commanding officer deems sufficient, a vessel of neutral or uncertain nationality. State in detail the captor's duties as to papers, persons, and cargo found on board, prize-master and crew, destination and delivery of prize, and state what is to be done if for any cause the prize cannot be sent in. If the ship clearly belongs to an enemy, how does that affect the case?

IX. War between United States and Great Britain. (a) Two American merchantmen are captured by British cruisers. One of them, the *Rose*, is carried into Valparaiso and condemned by a British prize-court sitting there. The other, the *Estelle*, is carried into Callao, and condemned by the Admiralty Court in London. Both are sold to Chilians, and afterwards come, under the Chilean flag, to the port of San Francisco. Can both, or either, be claimed by original owner? Give reasons.

(b) The *Bonsecours*, a French bark, is captured by an American cruiser, on a voyage from Bordeaux to Bristol, with a cargo of wine, the property of Eschenauer & Co., of Bordeaux and New York. One partner of the firm is an American, resident in Bordeaux, the other a citizen and resident of New York. The ship has French papers and belongs to a Frenchman. What will be the decision in regard to (1) vessel, (2) cargo?

X. War between United States and Great Britain. (a) In command of the U. S. S. *Tennessee*, cruising in the Atlantic, you capture an English brig, and send her in. It appears on the trial that she had been captured early in the war by the U. S. S. *Trenton*, and recaptured from the prize crew by H. M. S. *Minotaur*. The officers of the *Trenton* put in a claim for the prize. Discuss.

(b) Later, the *Trenton* is lying off Cadiz, and her boats attack and capture two English dispatch vessels at the entrance of the harbor. The prizes are brought out and burned. Discuss this, and describe the negotiations that would follow.

(c) Towards the close of the war you are cruising in the South Atlantic. While there a treaty of peace is made, and ratifications are exchanged on the 10th June; but 30 days from that date are allowed for captures in those waters. On the 20th June, in ignorance of the treaty, you take an English bark and send her in with a prize crew. On the 20th July she is recaptured by H. M. S. *Danaë*. Results?

DEPARTMENT OF MODERN LANGUAGES.

SPANISH (ELECTIVE).

JUNE, 1880.—Time allowed, three hours.

Translate into English.

Señores Cadetes de la primera Clase:

Cuatro años de ejercicios militares en los que habeis practicado la obediencia y el mando, han debido convenceros de la necesidad y de las ventajas de la disciplina. Permitid, sin embargo, á vuestros Instructores una observacion sobre este punto. Todos los pueblos, lo mismo que todos los ejércitos, temen la ley porque es poderosa; pero un pueblo libre, legislador de sí mismo, la venera mas de lo que la teme. Vosotros sois el brazo armado de esta República; vais á representarla en las diferentes naciones del mundo, y vuestra conducta militar será, en ellas, objeto de especial observacion. Mostrad con esa conducta, señores, la obediencia del hombre libre: mostrad que la disciplina bien entendida, es decir, el respeto á la ley, y á las órdenes hasta en sus mas mínimos detalles, es para vosotros, el mas alto deber del soldado del pueblo!

El gobierno, con gran sabiduria, ha puesto esta Escuela bajo la direccion de caballeros de elevado grado, distinguidos por su saber y por sus hechos, y, como hombres

que conocen el mundo, sumamente corteses: su diario ejemplo os ha enseñado de un adagio español: "nada quita lo cortés á lo valiente." Mirad la solo como un adorno, sino como un poder de grandes consecuencias: ella, viene desastres que su falta hubiera, tal vez, ocasionado á los pueblos. S y fieles en vuestros negocios privados; el verdadero militar es ante todo obrad, en fin, de modo que los extranjeros digan: "las Instituciones de Unidos hacen, no solo mas felices, sino mejores á sus ciudadanos." Pero los sejos. Pensemos que mañana vuestras ansiosas familias, vuestros amigos congratular con cariño, y con inefable sonrisa, quizas, la amiga predilecta. Vuestros Instructores juntan su afecto á aquel cariño, porque quedan su vuestra conducta

A Dios, señores Cadetes de la primera Clase: que vuestro porvenir sea feliz. El Gefe de Departamento, y los Instructores del ramo de Español.

Translate into Spanish.

POUR S'EMBARQUER À BORD D'UN NAVIRE À VOILES.

1. Pourriez-vous m'indiquer le capitaine du navire ?
2. Oui monsieur, c'est lui qui a l'honneur de vous parler.
3. Votre serviteur Mr. à quelle heure partez-vous demain ?
4. Je partirai au premier vent favorable.
5. Quel est le prix de la traversie ?
6. Trois mille francs, monsieur.
7. Je ne voyage pas seul ; j'ai avec moi ma femme, deux enfants et un chien. Ne me fera-t-on pas une diminution sur le prix du passage ?
8. Quel âge ont vos enfants ?
9. L'un a neuf ans, et l'autre en a sept.
10. Les enfants au-dessous de dix ans paient moitié place et nourriture; accordé un lit pour deux enfants.
11. Avez-vous beaucoup de passagers ?
12. J'en ai beaucoup et de tous les pays.
13. A quelle heure faut-il envoyer mes bagages ?
14. Il faut qu'ils soient ici aujourd'hui avant la nuit.
15. Combien de temps raterons-nous en route ?
16. Un mois, monsieur.

GRAMMAR.

1. How many ways are there in Spanish of addressing a person ?
2. Why is the pronoun subject sometimes omitted in Spanish ?
3. When is *el suyo* used instead of *el de V.* ?
4. How are nouns terminating in a short or unaccented vowel made plural ?
5. How are those ending in a long or accented vowel made plural ?
6. What is the position of the pronouns *it* and *to it* ?
7. How when the verb is in the infinitive ?
8. When both pronouns have to be made use of, which one comes first ?
9. Explain when *to be* is translated by *Ser* and when by *Estar*.
10. How many conjugations in Spanish ? Give in a table :
 - (a.) The present indicative, first singular and plural.
 - (b.) The third person singular and plural, past definite.
 - (c.) The present subjunctive, second person singular.
 - (d.) The future first and second person singular of *Haber*, *Estar*, *Acostarse*, *Dar*, *Hacer*, *Caber*, *Poder*, *Querer*, *Saber*, *Sentir*, and *Ir*.

NAVIGATION.

Time allowed, nine hours.

1. Show the relation between the departure in a given latitude and the corresponding difference of longitude. Represent by a plane triangle the quantities in Mercator's sailing. Explain the construction of Tables I and II, Bowditch's. Find by inspection of the tables the course and distance between two points by Mercator's sailing. Find them from a Mercator's chart.

2. State the advantages of a Mercator's chart, and the ratio in which the great and small portions of the meridians are expanded. Define refraction and dip of the semi-diameter. In what order, strictly, should the reductions be applied to the observed altitude of a heavenly body to find the true altitude of the centre? Give the correct name of the angle obtained by applying each reduction.

3. At sea, the longitude and time being known, and the approximate bearing of the moon being SSE., the altitude of its upper limb is observed by sextant: deduce the formula for computing the latitude. Describe in detail the preparation of the tables for use in the formulas.

4. In the problem of the preceding question, what additional data must be known in order to determine a line of position? Having plotted the line of position on a chart, how can you find by inspection the effect of an error in the altitude, and of an error in the time? Deduce a formula for finding the effect of an error in the time on the resulting latitude.

5. What are the uses of a single line of position? Intersecting lines have been found from observations of the same body, and the ship having moved in the interval, how is the position found on the chart at the time of the second observation? If the altitude is taken of a body very near the meridian, what is the ordinary correction to the meridian, and how is it used?

6. Deduce the equation of equal altitudes. Explain each step in computing the error of a chronometer when the sun is observed (a. m. and p. m.). How is the error of a chronometer found?

7. What should be the length of a knot of the log line for use with a glass running 31.3 seconds of time? How is the index glass of a sextant adjusted? the index glass? How is the index error found? Describe the azimuth circle of a Bessel's compass, and the manner of using it to find the compass bearing of the sun.

8. How is a theodolite adjusted in order that there may be no collimation error? Give one method of running in accurately the shore line between two stations in a harbor survey, and of plotting it upon a chart on which all the triangulation stations are fixed. How are the soundings taken, reduced, and fixed upon the chart?

9. What observations are made in the course of a survey to find the set and drift of the current? Define stand, slack, spring tide, and half-monthly inequality. What is a bench-mark, and what is its use?

10. What is a polyconic chart? Give its properties. Describe one complete method of making a deviation table. State the causes of semicircular deviation, quadrantal deviation, and heeling error.

11. At noon, May 23, 1880, took departure, Cape Hatteras light, in Lat. $35^{\circ} 50' N.$, Long. $75^{\circ} 30' 54'' W.$, bearing per compass NNW., and distant three miles. Ship's head SE., and the deviation for that course $\frac{1}{2}$ pt. east. Variation from the true $2^{\circ} 50'$ ($\frac{1}{2}$ pt.) west. Thence sailed till noon, May 24, as follows:

Compass courses.	Knots.	Wind.	Leeway.	Deviation.
SE. $\frac{1}{2}$ S.	50.5	Nd. and Ed.	$\frac{1}{2}$ pt.	$\frac{1}{2}$ pt. E.
N. $\frac{1}{2}$ E.	43	do.	do.	None.
E. by S.	47.8	do.	do.	$\frac{1}{2}$ pt. E.
NW. by N. $\frac{1}{2}$ N.	17	do.	$\frac{1}{2}$ pt.	$\frac{1}{2}$ pt. W.
NE. by E. $\frac{1}{2}$ E.*	38	Nd.	do.	$\frac{1}{2}$ pt. E.

* Run to noon, May 24, from hour of morning time-sight.

Required, Lat. and Long. by D. R. at noon May 24, 1880. Course and distance by J. R. from the light-house. May 24, 1880, Obs. merid. alt. sun's lower limb $76^{\circ} 11'$ bearing south. In. cor. — $1' 10''$. Height of eye, 18 feet.

Required, the latitude.

May 24, 1880, a. m. W. T. obs. $7^h 52^m 33^s$, C-W. $3^h 52^m 10^s$, c. c. + $1^h 08^m 16^s$.

Obs. alt. sun's lower limb $35^{\circ} 49' 10''$. In. cor. — $1' 10''$. Height of eye, 18 feet.

Bearing of the sun by standard compass N. $84^{\circ} 10'$ E. Ship's head ENE.

Required, longitude at noon, May 24, 1880; total error and deviation of the compass; set and drift of the current.

12. Find the time of high water on May 24, 1880, at Singapore, in Lat. $1^{\circ} 17' N.$, Long. $103^{\circ} 50' E.$, the establishment of the port being $9^h 45^m$.

13. At sea, May 25, 1880, in morning twilight. Long. $72^{\circ} 12' W.$ W. T. obs. $4^h 20^m 23^s$ a. m., C-W. $10^h 12^m 47^s$, c. c. + $6^h 51^m 14^s$. Obs. alt. of star and Ursæ Minoris (Polaris) $38^{\circ} 12' 30''$. In. cor. — $1' 10''$. Height of eye, 18 feet.

Required, the latitude.

14. At sea, May 26, 1880. Long. $145^{\circ} 36'$ East. Obs. merid. alt. noon's upper limb $25^{\circ} 30' 20''$ bearing south. In. cor. — $1' 10''$. Height of eye, 18 feet.

Required, the latitude.

15. Each cadet-midshipman will take observations in the field and find the chronometer error, the error of the compass, and the apparent altitude of a designated object on the opposite side of the Severn River. Height of observer's feet above the sea level, 20 feet. Distance from the observer of the shore line below and in the same vertical circle as the designated object, 3,300 feet.

Note.—Questions 8, 13 and 14 are alternatives. Double weight is assigned to question 15.

FRENCH.

Translate into French.

MILITARY EDUCATION AMONG THE ROMANS.

Everything contributed to inspire the Romans with martial ardor. The continual wars they had to maintain against their neighbors made the art of war necessary and familiar to them; and even the plough, which constituted their usual employment, prepared them for military toil. Rural occupations harden and fortify the soldier, whereas the trades practised in towns are only fit to enervate him. Fatigue cannot discourage him who exchanges the plough for the sword. The Roman soldiers were accustomed to walk in five hours twenty and sometimes twenty-four miles, and on the march they carried sixty pounds weight. Young Romans of every condition hardened themselves by martial exercise. After long races on foot or on horseback, they threw themselves, covered with sweat, into the Tiber, which they swam across. It was thus officers and soldiers were formed; and "the Roman youth," says Sallust, "as soon as they were able to carry arms, learnt the art of war by performing in the camps the most arduous tasks. They prided themselves not in giving feasts or submitting to pleasure, but on having beautiful arms and horses. No difficulty discouraged such men, and no enemy inspired them with fear; their courage rendered them superior to all; emulation fired their mind, and to distinguish themselves by some noble action was all their ambition. It was thus they endeavored to secure the esteem of their countrymen—in this they conceived true nobility to consist." The soldiers thus hardened from their earliest youth enjoyed good health, and the Romans who waged war in so many climates do not appear to have suffered much by illness, whereas it often happens in our days that armies, without having fought, disappear in a single campaign.

Translate into English.

LES FEUX DE ROUTE.

Les feux de côté.

Le feu vert de tribord.

Le feu rouge de bâbord.

Le feu blanc de tête de mât.

Montrer un feu d'une partie visible du bâtiment.

que tout navire sous voiles, ayant de la vapeur, mais ne s'en servant
comme navire à voiles, en cas d'abordage.

Tout navire en marche doit porter un feu vert à tribord et un

Les navires à vapeur portent, en outre, un feu blanc en tête.

Les feux de côtés doivent être pourvus, en dedans du bord
trois pieds au moins, en avant de la lumière afin que le feu
soit aperçu du bossoir de l'autre bord.

Les navires qui remorquent portent deux feux blancs en tête.

En temps de brume, les navires à vapeur en marche font allumer
les bâtiments sous voiles font usage d'un cornet à bouquin;
cloche.

Ces signaux doivent se faire entendre, au moins une fois, à

Translate into English.

PAVOISER.

Monsieur, Je viens vous prévenir que, demain matin, nous passons
de l'anniversaire de l'Indépendance et vous demander si vous viendrez
à cette fête, en pavoisant également votre navire?

Certainement, monsieur, car je suis heureux de saisir cette occasion
pour que nous aimons à sympathiser avec vous, nous mettrons nos couleurs
dehors. Dites-moi, s'il vous plaît, à quelle heure vous hisserez

Juste aux couleurs, c'est-à-dire, à 8 heures précises et en même temps
une salve de vingt et un coups de canon. Vous entendrez également
que j'ai sur le pont, au moment où nous casserons les genouilles
déployera en tête du grand mât. Nous vous sommes bien obligés
dire que pour fêter davantage ce beau jour, nous donnons un bal à
midi, et nous espérons que vous voudrez bien l'honorer de votre présence.

Je vous remercie bien, nous acceptons de grand cœur et nous nous
d'aller à la fête, partager votre joie. Ainsi, nous pouvons compter
pouvez y compter, sans faute.

Conversation entirely in French.

INDEX TO EXAMINATION PAPERS.

	Page.
andidates for admission as Cadet-Engineers.....	68
urth class	80, 81
Geometry, third class	89
, candidates for admission as Cadet-Midshipmen.....	64, 65
, candidates for admission as Cadet-Engineers.....	68
, second class, Cadet-Midshipmen	99
elective), third class.....	90
second class.....	103
elective), second class.....	105
on of the United States, third class	92, 93
ing (elective), fourth class	82
e Geometry, fourth class, Cadet-Engineers.....	82
e Geometry, third class, Cadet-Midshipmen.....	88
e Geometry, third class, Cadet-Engineers.....	89
Machinery, first class, Cadet-Engineers.....	115
Machinery, second class, Cadet-Engineers.....	101
d History, fourth class	84
urth class, monthly examination	83
urth class	84
History, third class.....	92
urth class.....	86
ird class	95
ond class.....	106
ss of 1878	123
, candidates for admission as Cadet-Midshipmen	65, 66
, candidates for admission as Cadet-Engineers.....	70
candidates for admission as Cadet-Engineers.....	69
fourth class.....	81
candidates for admission as Cadet-Midshipmen	64, 65
candidates for admission as Cadet-Engineers.....	70
second class, Cadet-Midshipmen.....	98
class of 1878	121
second class, Cadet-Midshipmen.....	98
nd class.....	100
uropean, third class	92
the United States	85
aval, third class	94
alculus (elective), third class.....	90
nal Law, first class.....	118
gines, first class, Cadet-Midshipmen.....	113
gines, first class, Cadet-Engineers.....	114
(elective), second class.....	105
, second class.....	104
Least Squares, first class, Cadet-Engineers.....	117

Punctuation, fourth class.....	.....
Rhetoric, third class.....	.....
Seamanship, first class, Cadet-Midshipmen .....	.....
Seamanship, second class, Cadet-Midshipmen .....	.....
Ship-Building, first class.....	.....
Spanish (elective), first class.....	.....
Spanish (elective), third class.....	.....
Spelling, candidates for admission as Cadet-Midshipmen.....	.....
Spelling, candidates for admission as Cadet-Engineers .....	.....
Strength of Materials, first-class, Cadet-Engineers.....	.....
Surveying and Compass Deviations .....	.....
Trigonometry, third class.....	.....

V
415
H3

STORAGE
4x4

ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

ANNAPOLIS, MD.

THIRTY-SECOND ACADEMIC YEAR.

1881-82.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1881.



ANNUAL REGISTER

OF THE

UNITED STATES NAVAL ACADEMY,

Received - Willard & Son
ANNAPOLIS, MD.

THIRTY-SECOND ACADEMIC YEAR.

1881-82.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1881.



CONTENTS.

	Page
AL SKETCH	4
SUPERINTENDENTS	5
OF VISITORS	6
CALENDAR	6
R, 1881-82	7
BOARD	8
OFFICERS	11
WITH RELATIVE STANDING IN CLASSES	12
ANNUAL SUMMARY	31
ADMISSIONS AND DISMISSALS	32
PRACTICE	33
-CRUISE, 1881	34
COEFFICIENTS	38
LESS, 1880-81	39
TESTS FOR ADMISSION	55
OF INSTRUCTION	60
ME OF RECITATIONS	74
EXAMINATION-PAPERS, 1880-81	78
EXAMINATION-PAPERS	133

mally opened October 10, of that year, under the name of the Naval School, with Commodore Franklin Buchanan as Superintendent. It was placed at the land occupied by Fort Severn, which was given up by the Navy for the purpose. The course was fixed at five years, of which the first year was spent at the School, the intervening three being passed at sea. The plan was not strictly adhered to, the exigencies of the service making it necessary in some cases, to shorten the period of study. In January, 1846, four months of the School, the students consisted of 36 Midshipmen, of the date of 1845, preparing for the examination for promotion; 13 of the date of 1846, remaining on the main until drafted for service at sea; and 7 Acting Midshipmen, of the date of September of the previous year. The Midshipmen of the date of 1846 graduated, finishing their limited course in July, 1846, and they were followed by the subsequent dates, until the reorganization of the School, in 1849.

In September, 1849, a Board was appointed to revise the plan and reorganize the Naval School. The Board was composed of the following officers:

Commodore William B. Shubrick,
Commander Franklin Buchanan,
Commander Samuel F. Dupont,
Commander George P. Upshur,
Surgeon W. S. W. Ruschenberger,
Professor William Chauvenet,
Captain Henry Brewerton, U. S. A.

The plan reported by the Board was approved, and went into operation.

The new organization provided for a course of seven years, the first three years at the School and the three intermediate years at sea. The School was placed under the supervision of the Bureau of Ordnance and Hydrography, which was changed to the United States Naval Academy. The corps of professors was extended, and the system of separate department heads, was fully adopted. It was provided that a Board of Visitors should make an annual inspection of the Academy, and report upon its condition to the Navy. A suitable vessel was attached to the Academy as a practice ship, and annual practice-cruises were begun.

After the system had been in operation a year new changes were made, and the recommendations of the Academic Board on the subject were referred to the Navy Department.

the middle of the course, thus making the four years of study consecutive. The practice-cruise supplied the place of the omitted sea-service, and gave better opportunities of training. The change went into operation in November, 1851, together with other improvements recommended by the Board. The system has continued, with slight modifications, to the present time. The first class to receive the benefit of it was that which entered in 1851. Six members of this class completed the course in three years, and were graduated in June, 1854; the rest of the class followed in 1855.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and the remaining Acting Midshipmen were quartered in the Atlantic House and on board the frigates Constitution and Santee. In September, 1865, the Academy was moved back to Annapolis, where it has since remained.

When the Bureau of Navigation was established, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. On the 11th of March, 1869, all official connection with the Bureau came to an end.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class was graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and was graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy in 1874 and the second in 1875. By an act of Congress approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years instead of two; and the new provision was first applied to the class entering the Academy in the year 1874. This class was graduated in June, 1878.

SUPERINTENDENTS OF THE NAVAL ACADEMY SINCE ITS FOUNDATION.

Assumed Command:

- Sept. 3, 1845.—Commander Franklin Buchanan.
- Mar. 15, 1847.—Commander George P. Upshur.
- July 1, 1850.—Commander Cornelius K. Stribling.
- Nov. 1, 1853.—Commander Louis M. Goldsborough.
- Sept. 15, 1857.—Captain George S. Blake.
- Sept. 9, 1865.—Rear-Admiral David D. Porter.
- Dec. 1, 1869.—Commodore John L. Worden.
- Sept. 22, 1874.—Rear-Admiral C. R. P. Rodgers.
- July 1, 1878.—Commodore Foxhall A. Parker.
- Aug. 2, 1879.—Rear-Admiral George B. Balch.
- June 13, 1881.—Rear-Admiral C. R. P. Rodgers.

BOARD OF VISITORS, JUNE, 1881

Rear-Admiral C. R. P. RODGERS, U. S. Navy, <i>President</i> .	
Hon. JOHN F. MILLER, <i>Vice-President</i> .	U. S. Senate.
Hon. J. T. MORGAN, ...	U. S. Senate.
Hon. JON. SCOVILLE, ...	House of Representatives.
Hon. THOMAS M. BROWNE, ...	House of Representatives.
Hon. OLIN WELLBORN, ...	House of Representatives.
Commodore S. P. CARTER, ...	U. S. Navy.
Medical Director JOHN M. BROWNE, .	U. S. Navy.
Chief-Engineer C. H. LORING, ...	U. S. Navy.
W. M. CALDWELL, Esq., ...	Newport, R. I.
D. B. McCREARY, Esq., ...	Erie, Pa.
Rev. S. S. CUTTING, D. D., ...	Westport, N. Y.
Captain JAMES PARKER, ...	Perth Amboy, N. J.
BEVERLY TUCKER, Esq., ...	Washington, D. C.
W. J. BIBB, Esq., ...	Montgomery, Ala.
F. W. LAURENCE, Esq., ...	Brookline, Mass.

ACADEMIC CALENDAR.

1881-1882.

1881.	
Oct. 1.—Beginning of first term	Saturday.
1882.	
Jan. 23-28.—Semi-annual examination	Monday—
Jan. 28.—End of first term	Saturday.
June 1-10.—Annual examination	Thursday
June 10.—End of academic year, 1881-82	Saturday.
June 12.—Examination of candidates for admission as Ca- det-Midshipmen	Monday.
Sept. 15.—Examination of candidates for admission as Ca- det-Engineers	Friday.
Sept. 22.—Examination of candidates for admission as Ca- det-Midshipmen	Friday.
Oct. 2.—Beginning of first term, 1882-83	Monday.

The academic months end on the following days:

1881-1882.

October	Oct. 29	February
November	Nov. 26	March
December	Dec. 24	April
January	Jan. 21	May

1882-1883.

October	Oct. 28	December
November	Nov. 25	January

CALENDAR FOR 1881-'82.

SEPTEMBER.							MARCH.						
Sun.	M.	T.	W.	T.	F.	Sat.	Sun.	M.	T.	W.	T.	F.	Sat.
-----	-----	-----	-----	1	2	3	-----	-----	-----	1	2	3	4
4	5	6	7	8	9	10	5	6	7	8	9	10	11
11	12	13	14	15	16	17	12	13	14	15	16	17	18
18	19	20	21	22	23	24	19	20	21	22	23	24	25
25	26	27	28	29	30	-----	26	27	28	29	30	31	-----
OCTOBER.							APRIL.						
-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	1
2	3	4	5	6	7	8	2	3	4	5	6	7	8
9	10	11	12	13	14	15	9	10	11	12	13	14	15
16	17	18	19	20	21	22	16	17	18	19	20	21	22
23	24	25	26	27	28	29	23	24	25	26	27	28	29
30	31	-----	-----	-----	-----	-----	30	-----	-----	-----	-----	-----	-----
NOVEMBER.							MAY.						
-----	-----	1	2	3	4	5	-----	1	2	3	4	5	6
6	7	8	9	10	11	12	7	8	9	10	11	12	13
13	14	15	16	17	18	19	14	15	16	17	18	19	20
20	21	22	23	24	25	26	21	22	23	24	25	26	27
27	28	29	30	-----	-----	-----	28	29	30	31	-----	-----	-----
DECEMBER.							JUNE.						
-----	-----	-----	-----	1	2	3	-----	-----	-----	-----	1	2	3
4	5	6	7	8	9	10	4	5	6	7	8	9	10
11	12	13	14	15	16	17	11	12	13	14	15	16	17
18	19	20	21	22	23	24	18	19	20	21	22	23	24
25	26	27	28	29	30	31	25	26	27	28	29	30	-----
JANUARY.							SEPTEMBER.						
1	2	3	4	5	6	7	-----	-----	-----	-----	1	2	-----
8	9	10	11	12	13	14	3	4	5	6	7	8	9
15	16	17	18	19	20	21	10	11	12	13	14	15	16
22	23	24	25	26	27	28	17	18	19	20	21	22	23
29	30	31	-----	-----	-----	-----	24	25	26	27	28	29	30
FEBRUARY.							OCTOBER.						
-----	-----	-----	1	2	3	4	1	2	3	4	5	6	7
5	6	7	8	9	10	11	8	9	10	11	12	13	14
12	13	14	15	16	17	18	15	16	17	18	19	20	21
19	20	21	22	23	24	25	22	23	24	25	26	27	28
26	27	28	-----	-----	-----	-----	29	30	31	-----	-----	-----	-----

OFFICERS
OF THE
UNITED STATES NAVAL ACADEMY.

REAR-ADMIRAL C. R. P. RODGERS,

SUPERINTENDENT.

COMMANDER S. D. GREENE,

Senior Aid to the Superintendent.

ACADEMIC STAFF.

COMMANDER F. V. MCNAIR,

Commandant of Cadets.

LIEUTENANT-COMMANDER C. W. KENNEDY,

Assistant to the Commandant of Cadets.

SEAMANSHIP, NAVAL TACTICS, AND NAVAL CONSTRUCTION.

COMMANDER N. H. FARQUHAR,

Head of Department.

LIEUTENANT-COMMANDER JOHN SCHOUER,

LIEUTENANT-COMMANDER EDWIN WHITE,

LIEUTENANT HENRY N. MANNEY,

LIEUTENANT E. DE F. HEALD,

LIEUTENANT D. DELEHANTY,

Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,

Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER H. B. ROBESON,

Head of Department.

LIEUTENANT-COMMANDER C. M. THOMAS,

LIEUTENANT J. W. MILLER,

LIEUTENANT RICHARD RUSH,

LIEUTENANT T. B. M. MASON,

LIEUTENANT WILLIAM P. POTTER,

Instructors in Naval Gunnery and Infantry Tactics.

ANTOINE J. CORRESIER,

Sword-Master.

JEAN B. RETZ,

GEORGE HEINTZ,

Assistant Sword-Masters.

MATHEMATICS.

PROFESSOR W. W. HENDRICKSON,

Head of Department.

LIEUTENANT ASA WALKER,
LIEUTENANT C. S. SPERRY,
LIEUTENANT BENJAMIN F. TILLEY,
LIEUTENANT F. G. HYDE,
LIEUTENANT H. W. SCHAEFER,
MASTER T. B. HOWARD,

Instructors in Mathematics.

STEAM-ENGINEERING.

Head of Department.

PASSED ASSISTANT ENGINEER W. A. WINDSOR,
PASSED ASSISTANT ENGINEER J. C. KAFFER,
PASSED ASSISTANT ENGINEER R. W. MILLIGAN,
PASSED ASSISTANT ENGINEER J. S. OGDEN,
PASSED ASSISTANT ENGINEER A. M. MATTICE,
PASSED ASSISTANT ENGINEER G. B. RANSOM,
PASSED ASSISTANT ENGINEER A. B. CANAGA,

Instructors in Steam-Engineering.

ASTRONOMY, NAVIGATION, AND SURVEYING.

COMMANDER P. F. HARRINGTON,

Head of Department.

LIEUTENANT-COMMANDER JOSEPH E. CRAIG,
LIEUTENANT J. G. EATON,
LIEUTENANT RAYMOND P. RODGERS,
Instructors in Astronomy, Navigation, and Surveying.

PHYSICS AND CHEMISTRY.

PROFESSOR HENRY D. TODD,

Head of Department.

LIEUTENANT CHARLES BRIDGEMAN,
LIEUTENANT EDWARD P. WOOD,
LIEUTENANT J. F. MEIGS,
LIEUTENANT J. B. MURDOCK,
PROFESSOR N. M. TERRY, A. M., PH. D.,
PROFESSOR CHARLES E. MUNROE, S. B.,

Instructors in Physics and Chemistry.

MECHANICS AND APPLIED MATHEMATICS.

PROFESSOR J. M. RICE, S. B., PH. D.,

Head of Department.

LIEUTENANT-COMMANDER S. H. BAKER,
LIEUTENANT CHARLES A. STONE,
LIEUTENANT ALEXANDER MCCrackIN,
PROFESSOR WILLIAM WOOLSEY JOHNSON, A. M.,
Instructors in Mechanics and Applied Mathematics.

ENGLISH STUDIES, HISTORY, AND LAW.

PROFESSOR J. RUSSELL SOLEY, A. B.

Head of Department.

LIEUTENANT WILLIAM T. BURWELL,

LIEUTENANT E. D. TAUSSIG,

LIEUTENANT J. B. BRIGGS,

LIEUTENANT N. T. HOUSTON,

LIEUTENANT M. FISHER WRIGHT,

PROFESSOR WILLIAM W. FAY, A. M.,

Instructors in English Studies, History, and Law.

MODERN LANGUAGES.

PROFESSOR L. F. PRUD'HOMME, A. M.,

Head of Department.

LIEUTENANT H. L. GREEN,

MASTER JOHN F. PARKER,

ASSISTANT PROFESSOR A. V. S. COURCELLE,

ASSISTANT PROFESSOR EUGENE DOVILLIERS,

ASSISTANT PROFESSOR JULES LEROUX,

ASSISTANT PROFESSOR HIPPOLYTE DALMON,

Instructors in French and Spanish.

PROFESSOR PEDRO MONTALDO,

Instructor in Spanish.

DRAWING.

PROFESSOR MARSHAL OLIVER,

Head of Department.

ENSIGN JAMES H. SEARS,

ASSISTANT PROFESSOR C. F. BLAUVELT, N. A.,

Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

LIEUTENANT-COMMANDER FRANCIS A. COOK, *In charge of Practice-Ship.*

MEDICAL INSPECTOR A. C. GORGAS, M. D.

SURGEON WILLIAM A. CORWIN, M. D.

PASSED ASSISTANT SURGEON G. P. LUMSDEN, M. D.

PAY DIRECTOR JAMES D. MURRAY, *Treasurer.*PAYMASTER L. G. BILLINGS, *Commissary.*PAYMASTER ROBERT W. ALLEN, *Storekeeper.*

CHAPLAIN J. S. WALLACE, A. M.

ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*J. J. GRAFF, *Assistant Librarian.*R. M. CHASE, *Secretary.*

MARINE GARRISON.

CAPTAIN ROBERT W. HUNTINGTON, *Commanding.*

FIRST LIEUTENANT J. M. T. YOUNG.

FIRST LIEUTENANT GEORGE T. BATES.

BOATSWAIN A. M. POMEROY.

GUNNER ROBERT SOMMER.

MATES.

MURPHY	} Attached to the United States Gunnery-ship <i>Santee</i> and to the sloop-of-war <i>Dale</i> .
IN F. LEE	
IAM G. SMITH	
S HILL	} Attached to the United States Steamer <i>Nantucket</i> .
ET SILVER	
AMIN G. PERRY	
PH ROGERS	} Attached to the United States Steamer <i>Phlox</i> (steam tender).

ACADEMIC BOARD.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N.
 COMMANDER F. V. MCNAIR, U. S. N.
 COMMANDER N. H. FARQUHAR, U. S. N.
 COMMANDER H. B. ROBESON, U. S. N.
 COMMANDER P. F. HARRINGTON, U. S. N.
 PROFESSOR W. W. HENDRICKSON, U. S. N.
 PROFESSOR J. M. RICE, PH. D., U. S. N.
 PROFESSOR J. R. SOLEY, A. B., U. S. N.
 PROFESSOR H. D. TODD, U. S. N.
 PROFESSOR L. F. PRUD'HOMME, A. M., U. S. N.
 PROFESSOR MARSHAL OLIVER, U. S. N.

CADET-OFFICERS.

CADET-LIEUTENANT-COMMANDER.

L. NIXON.

CADET-LIEUTENANTS.

S. S. WOOD. W. B. DUNCAN.
 J. G. DOYLE. J. M. FOYER.

CADET-MASTERS.

S. A. W. PATTERSON, *Adjutant*.
 J. L. JAYNE. E. A. ANDERSON.
 J. G. MCWHORTER. H. H. KENKEL.

CADET-ENSIGNS.

L. SEMPLE. W. B. FLETCHER.
 W. L. HOWARD. W. T. PAINE.

CADET-PETTY-OFFICERS.

First Captains of Gun's Crews.

hnston.	A. L. Key.	W. B. Whittelsey.	H. H. Eames.
. King.	J. J. Blandin.	H. A. Horst.	G. E. Kent.
Prince.	N. M. Hubbard.	L. R. Savago.	C. Martin.
McNutt.	E. W. Sutphen.	L. S. Bennett.	J. T. Arnold.

** Second Captains of Gun's Crews.*

Stahlo.	F. L. Chapin.	G. W. Street.	H. Fowler.
. M. Field.	B. E. Thurston.	G. C. Stont.	J. B. Jackson.
Greene, Jr.	P. N. McGiffin.	P. H. Philbin.	R. W. Barkley.
. Toney.	L. S. Gwyn.	W. J. Grambs.	A. S. Keith.

CADET-PASSED-ASSISTANT-ENGINEER.

E. THEISS.

CADET-ASSISTANT-ENGINEERS.

R. W. GATEWOOD.

G. R. FERGUSON.

Cadet-Machinists.

. P. Creighton.	W. H. Chambers.	C. E. Rommell.	P. Miller.
Fitts.	O. C. Gsantner.	A. McAllister.	W. B. Addicks.

Order of general merit.	Name.	State.	Date of admission.
*1	Schock, John Loomis.....	Pennsylvania.....	June 19, 187
*2	Woodward, Joseph Janvier.....	At large.....	June 21, 187
*3	Linnard, Joseph Hamilton.....	Pennsylvania.....	June 21, 187
*4	Hoogewerff, John Adrian.....	At large.....	June 21, 187
*5	Sutton, Francis Eskridge.....	New York.....	June 21, 187
*6	Rees, John Livermore.....	Michigan.....	June 21, 187
*7	Dashiell, Robert Brooke.....	At large.....	June 19, 187
8	Rider, Frederic Clinton.....	Rhode Island.....	Sept. 12, 187
9	White, Harry Kidder.....	Dakota.....	Sept. 19, 187
10	Karmany, Lincoln.....	Pennsylvania.....	Sept. 12, 187
11	Capehart, Edward Everett.....	Ohio.....	June 22, 187
12	Carroll, Eugene.....	At large.....	June 19, 187
13	Eldredge, Houston.....	At large.....	Oct. 2, 187
14	Serata, Tasuker.....	Empire of Japan.....	Sept. 12, 187
15	Bunta, Frank Emory.....	Ohio.....	June 20, 187
16	Lauchheimer, Charles Henry.....	Maryland.....	Sept. 11, 187
17	Forsbaw, Robert Pierpont.....	New York.....	June 21, 187
18	Stayton, William Henry.....	Delaware.....	June 21, 187
19	Doyen, Charles Augustus.....	New Hampshire.....	June 21, 187
20	Mahoney, James Edward.....	Massachusetts.....	Sept. 12, 187
21	Wilson, Henry Braid.....	New Jersey.....	Sept. 11, 187
22	Andrews, Horace Burlingame.....	Michigan.....	June 22, 187
23	Hunicke, Felix Hermann.....	Missouri.....	Sept. 11, 187
24	Mosca, Franklin James.....	South Carolina.....	Sept. 11, 187
25	Wilkes, Gilbert.....	Utah.....	Sept. 12, 187
26	Urin, Sotokichi.....	Empire of Japan.....	Sept. 12, 187
27	Haines, Henry Cargill.....	At large.....	June 26, 187
28	Blow, George Preston.....	Virginia.....	Sept. 14, 187
29	Barnett, George.....	Wisconsin.....	June 19, 187
30	Perkins, Con Marrast.....	Georgia.....	Sept. 11, 187
31	Flournoy, William Francis.....	Louisiana.....	June 19, 187
32	Smies, Frederick William.....	Ohio.....	June 22, 187
33	Colwell, James Hall.....	At large.....	June 20, 187
34	Ballentine, Henry Laird.....	Tennessee.....	June 20, 187
35	Clarke, George.....	Illinois.....	June 22, 187
36	Robinson, William Moody.....	At large.....	June 21, 187
37	Buck, Guy Morville.....	Maine.....	Sept. 11, 187
38	Bryan, Samuel.....	Maryland.....	June 14, 187
39	Weeks, John Wingate.....	New Hampshire.....	June 21, 187
40	Harrison, Edward Hanson.....	At large.....	June 21, 187
41	George, Charles Peaslee.....	Illinois.....	July 1, 187
42	Weller, Ovington Eugene.....	Maryland.....	Sept. 12, 187

MIDSHIPMEN.

—72 members.

Order of merit in—										Number of demerits.	Sea-service in practice-ships.		Order of general merit.
Seamanship.	Ship building.	Ordnance and armor.	Marine engines.	Theoretical navigation.	Practical navigation and surveying.	Electricity.	Naval architecture (elective).	Public law.	French and Spanish.		Months.	Days.	
5	4	2	5	1	2	4	1	5	17	15	4	12	*1
4	8	4	1	2	4	3	3	9	29	39	4	12	*2
19	9	5	2	3	1	1	2	8	17	73	4	12	*3
8	11	6	5	7	3	2	4	3	21	75	4	12	*4
23	5	3	4	4	6	8	.....	2	1	38	4	12	*5
26	16	12	20	6	10	16	7	6	29	133	4	12	*6
1	2	1	8	24	15	15	.....	20	2	20	4	12	*7
57	13	19	9	10	15	5	8	32	34	117	4	12	8
9	6	10	3	11	7	6	6	19	11	32	4	12	9
0	13	8	13	5	5	7	.....	12	9	58	4	12	10
16	22	12	7	9	8	10	.....	36	4	55	4	12	11
18	20	21	27	14	11	20	.....	27	23	103	4	12	12
2	3	14	25	19	25	58	.....	16	34	63	4	12	13
46	51	27	65	14	17	14	8	52	63	88	4	12	14
9	38	23	20	32	18	28	.....	11	12	30	4	12	15
26	45	27	13	19	13	13	.....	10	5	85	4	12	16
28	15	10	10	22	14	21	.....	7	23	56	4	12	17
30	69	50	22	12	21	9	5	4	28	155	4	12	18
12	34	19	23	36	39	19	.....	15	13	130	4	12	19
31	10	9	11	50	36	16	.....	1	9	91	4	12	20
14	31	30	12	13	9	29	.....	30	59	78	4	12	21
11	40	37	18	27	24	32	.....	28	14	79	4	12	22
20	16	26	32	41	32	66	.....	50	3	60	4	12	23
44	39	30	23	14	20	12	.....	35	43	105	4	12	24
3	1	21	15	28	32	25	.....	30	38	120	4	12	25
23	46	54	55	17	26	30	.....	32	54	50	4	12	26
49	11	33	47	36	29	47	.....	53	45	141	4	12	27
7	7	7	25	43	42	67	.....	20	53	112	4	12	28
15	16	23	32	38	34	22	.....	28	70	42	4	12	29
52	19	37	61	55	60	51	.....	13	32	103	4	12	30
56	48	48	42	44	30	24	.....	22	6	120	4	12	31
61	26	30	45	50	37	57	.....	71	41	94	4	12	32
54	31	25	17	24	35	32	.....	40	22	89	4	12	33
31	40	42	52	45	42	41	.....	16	31	113	4	12	34
31	29	42	27	8	12	26	.....	25	62	106	4	12	35
40	34	16	30	30	27	35	.....	22	59	88	4	12	36
23	42	30	44	22	18	32	.....	38	54	43	4	12	37
16	52	33	36	35	38	47	.....	45	45	75	4	12	38
41	34	14	31	38	27	36	.....	16	60	87	4	12	39
42	48	60	19	58	42	49	.....	70	70	51	4	12	40
31	33	33	47	26	39	39	.....	44	38	72	4	12	41
42	56	40	55	18	21	39	.....	48	25	114	4	12	42

Class of 18

Order of general merit.	Name.	State.	Date of admission.	Age of admission
				Years.
43	Cohen, Harry Radcliffe	At large	June 20, 1877	15
44	Stewart, Charles West	Illinois	June 21, 1877	17
45	Kimball, John Arthur	Massachusetts	Sept. 12, 1877	17
46	Cranshaw, James Davis	Texas	Sept. 11, 1877	17
47	McJunkin, Ira	Pennsylvania	June 20, 1877	17
48	Hains, Robert Peter	Maine	Sept. 18, 1877	16
49	Cockle, Rudolphus Rouse	Illinois	June 21, 1877	17
50	Kase, Spencer Mettler	Illinois	Sept. 11, 1877	17
51	Printup, David Lawrence	New York	June 21, 1877	17
52	McCrea, Alexander Sterling	At large	Oct. 2, 1876	17
53	Ford, William Griffing	Arkansas	Sept. 11, 1877	17
54	Emmet, William Le Roy	At large	June 26, 1876	19
55	Craven, Macdonough	New York	June 21, 1876	17
56	Rodgers, Guy George	Tennessee	Sept. 23, 1876	16
57	Harmon, Eugene Marion	Ohio	June 20, 1877	17
58	Donnelly, Michael Joseph	Wisconsin	June 21, 1877	17
59	Dresser, James Walter	Minnesota	June 21, 1877	16
60	Wright, Silas Haynes	Michigan	June 28, 1876	17
61	Craig, Ben Holliday	Missouri	June 14, 1876	16
62	Matthews, Thomas Henry	Pennsylvania	Sept. 12, 1876	16
63	Williamson, Samuel Hill	North Carolina	Sept. 11, 1876	17
64	Bonfile, Thomas Lewis	Missouri	June 19, 1876	17
65	Oliphant, Alexander Coulter	New Jersey	Sept. 12, 1877	17
66	Vance, Zebulon Baird	North Carolina	June 22, 1876	17
67	McKee, Llewelyn Thomas	Pennsylvania	June 20, 1877	17
68	Morgan, Daniel	Kentucky	Sept. 11, 1877	17
69	Parsons, Arthur Carlton	Iowa	June 21, 1876	17
70	Perry, George Ernest	Illinois	Sept. 12, 1876	17
71	Hasson, Alexander Ritchie	At large	June 21, 1877	17
72	Enouye, Yonoske	Empire of Japan	Sept. 18, 1877	19

IPMEN.

s—Continued.

Order of merit in—									Sea-service in practice-ships.			Order of general merit.
Ship-building.	Ordnance and armor.	Marine engines.	Theoretical navigation.	Practical navigation and surveying.	Electricity.	Naval architecture (elective).	Public law.	French and Spanish.	Number of demerits.	Months.	Days.	
20	17	39	60	49	61	.....	14	26	46	4	12	43
62	52	37	31	23	37	.....	41	14	107	4	12	44
44	61	54	34	49	38	.....	64	47	134	4	12	45
23	45	16	32	69	26	.....	61	14	72	4	12	46
27	27	50	45	64	41	.....	32	33	30	4	12	47
30	33	32	56	56	70	.....	48	49	119	4	12	48
24	51	46	47	51	61	.....	41	50	146	4	12	49
58	56	64	49	64	23	.....	41	36	83	4	12	50
46	44	42	29	51	41	.....	46	41	152	4	12	51
48	49	59	61	58	44	.....	38	17	137	4	12	52
54	18	55	53	41	54	.....	57	57	121	4	12	53
27	58	39	64	60	18	.....	73	75	177	4	12	54
42	59	35	72	66	60	.....	63	40	138	4	12	55
62	62	51	58	53	67	.....	26	26	142	4	12	56
64	47	65	40	47	67	.....	55	50	136	4	12	57
24	46	41	42	53	31	.....	50	17	114	4	12	58
53	55	38	47	45	46	.....	55	64	171	4	12	59
60	53	47	50	67	50	.....	60	61	125	4	12	60
65	66	52	62	58	44	.....	36	52	105	4	12	61
66	75	65	70	71	54	.....	66	47	156	4	12	62
72	70	58	67	67	58	.....	53	44	145	4	12	63
70	71	72	53	48	70	.....	66	72	131	4	12	64
66	63	69	64	71	72	.....	46	58	48	4	12	65
58	73	70	64	62	56	.....	72	66	183	5	0	66
55	64	59	57	56	53	.....	57	69	112	4	28	67
66	64	65	67	62	73	.....	68	74	132	4	12	68
71	56	71	69	53	65	.....	59	65	102	4	12	69
74	72	72	71	70	64	.....	64	56	158	5	0	70
37	41	29	21	31	11	.....	22	36	113	7	15	71
a	76	a	a	a	a	.....	76	a	11	2	16	72

First

Order of annual merit.	Name.	State.	Date of admission.	Age at admission
				Years.
10	Anderson, Edwin Alexander.....	North Carolina	June 21, 1878	17
3	Arnold, John Thompson.....	Wyoming Ter	Sept. 27, 1877	17
6	Bennett, Louis Slocum.....	New Jersey.....	Sept. 11, 1877	15
13	Blandin, John Joseph.....	Alabama.....	June 21, 1878	15
11	Doyle, James Gregory.....	Pennsylvania.....	June 21, 1877	17
17	Duncan, William Buttler.....	New York.....	Nov. 1, 1878	14
34	Eames, Harold Hayden A.....	Maine.....	June 21, 1878	14
15	Field, Wiley Roy Mason.....	Virginia.....	June 21, 1878	15
4	Fletcher, William Bartlett.....	Vermont.....	Sept. 11, 1877	15
32	Fowler, Hammond.....	Virginia.....	Sept. 23, 1878	17
28	Grambs, William Jacob.....	Pennsylvania.....	Sept. 11, 1877	15
23	Gwyn, Lawrence Sangston.....	Mississippi.....	June 21, 1878	16
24	Horst, Henry August.....	Alabama.....	June 21, 1878	15
19	Howard, William Lauriston.....	Connecticut.....	Sept. 11, 1877	17
28	Hubbard, Nathaniel Mead.....	At large.....	Sept. 11, 1877	17
9	Jayne, Joseph Lee.....	Mississippi.....	June 21, 1878	15
7	Johnston, Marbury.....	Georgia.....	Sept. 23, 1878	17
27	Kenkel, Herman Henry.....	Minnesota.....	June 21, 1878	17
36	Kent, George Edward.....	New York.....	June 21, 1877	16
18	Key, Albert Lenoir.....	Tennessee.....	June 21, 1877	16
33	King, William Nephew, jr.....	Georgia.....	June 21, 1878	17
30	Martin, Clarence.....	Louisiana.....	June 21, 1878	16
25	McGiffin, Philo Norton.....	Pennsylvania.....	Sept. 11, 1877	16
35	McNutt, Finley Alexander.....	Indiana.....	Sept. 11, 1877	16
10	McWhorter, Jacob Gray.....	Georgia.....	Sept. 12, 1877	15
*1	Nix, Lewis.....	Virginia.....	June 21, 1878	17
21	Payne, Walter Taylor.....	Ohio.....	Sept. 11, 1877	14
†	Parker, Felton.....	Iowa.....	Nov. 6, 1876	14
29	Patterson, Samuel Achmuty Wainwright.....	At large.....	June 21, 1878	16
22	Poyer, John Martin.....	At large.....	June 21, 1877	15
12	Prince, Thomas Clayton.....	Ohio.....	June 21, 1878	17
14	Savage, Ledru Rollin.....	Illinois.....	Sept. 23, 1878	17
20	Seiple, Lorenzo.....	Alabama.....	Sept. 11, 1877	16
31	Stable, Frederick Henry.....	California.....	Sept. 11, 1877	17
5	Sutphen, Edson Webster.....	Nebraska.....	June 21, 1878	17
8	Whittlesey, William Bailey.....	New York.....	June 21, 1878	17
*2	Wood, Spencer Shepard.....	New York.....	June 21, 1878	17

† Turned back from the class of 1881.

PMEN.

ers.

Order of merit in—									Sea-service in practice- ships.		Order of annual merit.
Naval tactics.	Ordnance instructions and infantry tactics.	Astronomy.	Physics and chemistry.	Light and heat.	Mechanics and calculus.	English and history.	French.	Number of demerits.	Months.	Days.	
28	12	12	14	14	24	23	21	123	6	26	16
9	31	7	5	3	2	9	31	177	6	26	3
6	11	9	7	4	10	2	1	124	6	26	6
16	16	25	11	8	22	6	3	161	6	26	13
14	5	6	8	17	14	32	32	151	6	26	11
3	10	34	36	29	25	32	9	188	6	26	17
17	14	34	5	34	29	35	27	228	6	26	34
13	25	16	19	28	13	28	8	195	6	26	15
7	4	2	2	6	5	5	17	88	6	26	4
21	38	30	32	25	31	19	24	188	6	26	32
27	31	19	26	20	21	14	30	164	6	26	26
11	37	15	25	18	15	10	17	169	6	26	23
21	30	34	16	31	27	4	2	150	6	26	24
24	22	17	31	21	28	27	5	108	6	26	19
26	33	27	17	29	31	23	35	187	6	26	28
18	15	2	17	9	6	17	32	175	6	26	9
8	18	11	8	11	4	7	12	141	6	26	7
19	20	31	22	26	23	17	32	174	6	26	27
29	28	25	33	35	31	30	37	157	6	26	36
21	19	22	19	16	11	16	22	196	6	26	18
19	20	23	19	36	26	22	11	191	4	10	33
38	29	32	30	22	31	31	10	157	6	26	30
35	5	28	22	27	35	23	28	180	6	26	25
37	25	20	4	19	18	38	19	189	6	26	35
3	8	14	15	7	8	28	25	158	6	26	10
1	3	1	1	1	1	1	6	162	6	26	*1
36	34	23	28	23	8	36	7	81	6	26	21
									4	12	
10	9	32	33	23	29	34	35	150	6	26	29
32	27	21	27	14	20	19	22	171	6	26	23
25	13	10	22	13	19	7	15	35	6	26	12
30	17	13	11	5	16	14	20	96	6	26	14
15	23	17	28	31	17	13	3	158	6	26	20
33	23	28	35	31	36	37	14	155	6	26	31
12	7	5	3	12	7	3	26	78	6	26	5
5	2	8	13	9	12	26	29	76	6	26	8
2	1	4	10	2	3	12	13	56	6	26	*2

2 N A R

Sec

Order of annual merit.	Name.	State.	Date of admission.	Age
				Years.
16	Agee, Alfred Pelham	Alabama	June 11, 1879	16
13	Alexander, Robert Colder	Kentucky	Sept. 22, 1879	16
24	Balthie, Harry Hamilton	Illinois	June 11, 1879	17
6	Barkley, Richard Warren	Missouri	June 19, 1879	16
18	Barnard, John Hall	New York	Sept. 23, 1879	17
*3	Bowman, William Ezekiel	Michigan	Sept. 22, 1879	16
14	Brady, Cyrus Townsend	Kansas	Sept. 22, 1879	17
12	Chapin, Frederick Lincoln	Illinois	Sept. 22, 1879	16
28	Colvin, Frank Reginald	New York	Sept. 22, 1879	17
26	Dalrymple, Elton Wealey	Iowa	June 21, 1879	16
37	Dovaß, Arthur	New York	Sept. 23, 1879	17
11	Frazier, Robert Thomas	Tennessee	Sept. 23, 1879	16
8	George, Harry	Michigan	June 11, 1879	16
19	Gignilliat, Thomas Heywood	Georgia	Sept. 23, 1879	15
34	Gray, Willie Theodore	North Carolina	May 8, 1879	16
*1	Greene, Samuel Dana, Jr.	Rhode Island	June 18, 1879	16
20	Jackson, John Alexander	Florida	Sept. 22, 1879	17
*5	Jackson, John Brimckerhoff	New Jersey	Sept. 22, 1879	17
10	Keith, Albion Sherman	Massachusetts	Sept. 22, 1879	16
32	Ledbetter, William Hamilton	Texas	Sept. 22, 1879	17
36	Legaré, Alexander Brown	South Carolina	Mar. 20, 1879	16
21	Lerch, Robert Lee	Ohio	Sept. 22, 1879	16
15	Megrath, William Alonzo	Georgia	Sept. 22, 1879	17
30	Mitchell, Sidney Zollicoffer	Alabama	Sept. 23, 1879	16
29	O'Leary, Timothy Stephen	Massachusetts	Sept. 22, 1879	16
35	Pettit, Harry Corbin	Indiana	Sept. 22, 1879	15
25	Philbin, Patrick Henry	Maryland	June 21, 1879	17
9	Schrader, George Morrison von	Missouri	Sept. 23, 1879	16
39	Smith, Thomas Buchanan	Alabama	June 21, 1879	16
17	Stout, George Clymer	Pennsylvania	Sept. 22, 1879	17
*2	Street, George Washington	Wisconsin	Sept. 22, 1879	17
*4	Sweeting, Charles Edward	New York	Sept. 22, 1879	17
7	Thurston, Benjamin Eaton	Indiana	Sept. 22, 1879	16
27	Toney, Tremlet Vivian	Illinois	June 11, 1879	16
31	Weeks, Edwin Babbitt	Oregon	Sept. 23, 1879	16
33	Wilson, William Joseph	Ohio	Sept. 22, 1879	16
23	Witherspoon, Thomas Alfred	Tennessee	June 11, 1879	16
22	Woods, Robert Harris	Virginia	Sept. 23, 1879	16

IN.

Order of merit in—							Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
Trigonometry.	Analytical geometry.	Descriptive geometry.	Physics.	History and rhetoric.	French.	Drawing.		Months.	Days.	
13	14	15	25	13	20	45	184	4	29	16
22	17	11	9	17	21	12	65	4	29	13
26	37	29	11	15	28	22	114	4	29	24
8	9	4	16	3	11	1	74	2	17	8
15	34	20	9	25	29	2	186	4	29	18
5	3	5	15	2	7	7	146	4	29	*3
18	18	21	29	10	9	5	183	4	29	14
18	18	13	19	6	13	26	115	4	29	12
30	27	24	22	19	22	47	153	4	29	28
15	22	32	29	22	19	31	238	4	29	26
45	29	33	39	41	30	19	166	4	29	37
12	11	14	21	11	10	23	103	4	29	11
11	6	8	4	7	33	16	170	4	29	8
18	12	12	23	31	36	4	180	4	29	19
44	33	37	36	36	40	40	113	4	29	34
2	2	2	2	1	1	9	79	4	29	*1
17	20	25	17	23	14	29	231	4	29	20
4	5	7	3	9	4	14	65	4	29	*5
22	10	10	12	17	12	3	124	4	29	10
32	38	40	33	40	39	41	160	4	29	32
26	40	36	41	42	35	26	177	4	29	36
39	23	27	12	14	3	10	174	4	29	21
10	15	15	20	38	32	13	173	4	29	15
33	24	37	36	36	16	43	208	4	29	30
38	31	33	24	29	16	10	107	4	29	29
18	28	41	29	20	31	18	119	4	29	35
37	16	27	27	28	15	36	140	4	29	25
6	12	18	17	12	34	8	168	2	17	9
39	41	42	38	29	41	44	247	4	29	39
35	21	17	8	21	24	20	211	4	29	17
1	1	1	1	5	1	26	127	4	29	*2
3	4	3	6	7	5	15	263	4	29	*4
9	7	6	7	16	6	5	104	4	29	7
35	43	22	29	25	23	33	134	4	29	27
33	25	26	28	34	26	37	219	4	29	31
41	31	37	35	35	41	42	116	4	29	33
26	35	23	12	24	25	30	133	4	29	23
30	29	19	26	32	7	34	80	4	29	22

Third

Order of annual merit	Name.	State.	Date
33	Barker, William Alfred	Colorado	Sept. 1
6	Beecher, Albert Morrison	Iowa	June 1
37	Bush, William Witt, Jr.	New York	Sept. 1
29	Carter, Vaulx	Pennsylvania	Sept. 1
13	Cook, William Ellsworth	Ohio	Sept. 1
*1	Curtis, Frederic Ellsworth	Massachusetts	Sept. 1
22	Friedlander, Harry	California	Sept. 1
24	Harrell, John Randolph	Louisiana	Sept. 1
17	Hayes, Charles Harold	Pennsylvania	Sept. 1
25	Hazeltine, Charles Walter	Missouri	June 1
†	Hepp, Charles Frederick	Missouri	June 1
12	Hoggatt, Wilford Bacon	Indiana	June 1
23	Jastremski, Leon Henry	Louisiana	Sept. 1
21	Johnston, William	Mississippi	June 1
9	Jones, Hilary Pollard, Jr.	Virginia	Sept. 1
11	Leary, Thomas Horton	North Carolina	Sept. 1
27	Macpherson, Victor	Kentucky	Sept. 1
28	Maxey, John Wharton	Texas	June 1
31	McCook, John Anson	New York	Sept. 1
35	McCord, Harry Herrick	New York	June 1
15	McCreary, Wirt	Pennsylvania	June 1
20	McDonald, John Daniel	Nevada	Oct.
18	McIntire, Alonza Evans	Massachusetts	Sept. 1
5	McKean, Josiah Slutta	Ohio	Sept. 1
4	McNulta, Herbert	Illinois	June 1
*2	Moseley, Nathaniel Stockwell	California	Mar. 1
26	O'Malley, William Ambrose	Pennsylvania	Sept. 1
3	Plunkett, Charles Peshall	District of Columbia	Sept. 1
14	Seymour, Isaac Knight	Maine	Sept. 1
10	Shoemaker, William Rawle	New Mexico	June 1
19	Smith, Sidney Fuller	Massachusetts	Sept. 1
36	Sparling, Frederick Herbert	Washington Territory	Dec. 1
32	Stevens, Raymond Rodgers Watmough Bliss	Kentucky	Nov. 1
16	Terrell, Douglass Fuqua	Mississippi	Sept. 1
8	Welles, Roger, Jr.	Connecticut	Sept. 1
7	Williams, Clarence Stewart	Ohio	Sept. 1
34	Williams, William Plumb	Connecticut	June 1
30	Wirt, William Edgar	Ohio	Sept. 1

† Absent (sick).

EN.

of ad- v.	Order of merit in—					Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
	Seamanabip.	Mathematica.	English and history.	French.	Drawing.		Months.	Days.	
6	43	35	30	42	20	111	2	17	38
4	2	4	14	36	2	151	4	10	6
8	44	36	32	46	36	156	2	17	37
1	15	31	39	22	1	109	3	17	29
0	46	11	8	13	19	110	3	17	13
8	9	5	1	4	7	52	3	17	*1
11	45	10	29	8	39	209	2	17	22
7	19	26	24	19	9	142	2	17	24
8	20	24	20	30	4	38	2	17	17
2	25	28	11	29	34	161	4	10	25
2							2	12	†
9	4	12	12	34	43	55	4	10	12
11	29	12	41	3	27	254	4	10	23
10	10	20	36	1	23	160	4	10	21
10	22	14	16	2	27	81	3	17	9
11	18	9	21	26	30	61	2	17	11
3	28	24	25	40	44	181	2	17	27
5	34	21	26	28	47	209	4	10	28
2	14	29	31	41	22	223	2	17	31
5	33	38	36	31	24	316	4	10	35
1	7	22	5	27	17	256	3	17	15
11	35	16	21	15	42	67	2	17	20
0	25	22	18	10	10	296	4	10	18
3	7	2	8	5	16	292	2	17	5
6	5	7	4	22	12	125	4	10	4
0	1	3	2	13	6	256	4	10	*2
4	31	19	34	36	20	96	3	17	26
7	5	1	19	17	10	296	3	17	3
6	23	17	12	6	31	27	3	17	14
4	3	18	7	21	2	190	4	10	10
11	17	31	8	10	13	38	2	17	19
0	11	38	41	38	33	287	4	10	36
0	39	37	23	7	40	289	4	16	32
3	21	15	6	22	41	111	3	17	16
9	13	8	16	17	5	55	2	17	8
11	35	6	3	10	32	65	2	17	7
11	38	38	43	35	18	79	4	10	34
9	29	27	35	32	24	84	2	17	30

GADET-MIDSHIPMEN.

Fourth class—48 members.

Name.	State.	Date of admission.	Age at of ad- mission.
			Years.
Atwood, John Cowan.....	Missouri.....	June 11, 1880.....	17
Blake, Henry Davis.....	North Carolina.....	Sept. 20, 1880.....	18
Burnatine, Albert.....	Michigan.....	Sept. 22, 1881.....	17
Clark, Horry Dent.....	Georgia.....	June 11, 1881.....	16
Coontz, Robert Edward.....	Missouri.....	Sept. 22, 1881.....	17
Corpening, Charles Macon.....	North Carolina.....	June 11, 1881.....	16
Crisfield, James Alfred Pearce.....	Maryland.....	Feb. 1, 1881.....	16
Davis, James Sherlock.....	Ohio.....	June 11, 1880.....	17
De Krafft, John Charles Phillip.....	Iowa.....	Feb. 28, 1881.....	16
Dutton, Arthur Henry.....	Indiana.....	Sept. 21, 1881.....	17
Eberle, Edward Walter.....	Arkansas.....	Sept. 22, 1881.....	17
Edgar, Webster Appleton.....	New York.....	Sept. 22, 1881.....	17
Ferriss, Louis Duane.....	New York.....	Sept. 21, 1881.....	17
Gilson, Robert Ewing Lee.....	Missouri.....	June 11, 1881.....	17
Gilmer, William Wirt.....	Virginia.....	June 11, 1880.....	17
Howell, Robert Beecher.....	Michigan.....	Sept. 21, 1881.....	17
Jacobs, Benjamin.....	Kansas.....	June 11, 1881.....	16
Kittrell, James Wesson.....	Mississippi.....	Sept. 23, 1881.....	17
Lamison, Jason Gordon.....	Ohio.....	June 11, 1880.....	16
Leibetter, Thomas Pryor.....	Alabama.....	Sept. 21, 1881.....	15
Livingood, James Jameson.....	Pennsylvania.....	Sept. 22, 1881.....	15
Lombard, Benjamin Matthew.....	Iowa.....	Sept. 21, 1881.....	14
Luzenberg, Charles Kennard.....	Illinois.....	Sept. 21, 1881.....	16
McGuinness, John Patrick.....	Idaho Territory.....	Sept. 21, 1881.....	17
Nes, David Small.....	Pennsylvania.....	June 13, 1881.....	15
Pagin, James Richard.....	Indiana.....	Sept. 21, 1881.....	17
Pentz, George Shannon.....	New York.....	Oct. 14, 1881.....	18
Pitner, Samuel Ellis.....	Tennessee.....	Sept. 22, 1881.....	17
Poe, Charles Carroll.....	Pennsylvania.....	Sept. 21, 1881.....	17
Raichle, Frank Godfrey.....	New York.....	June 11, 1880.....	16
Robinson, Leonidas Leicester.....	Ohio.....	Sept. 22, 1881.....	17
Russell, Robert Lee.....	Georgia.....	June 14, 1881.....	16
Sargent, Frederic Homer.....	Illinois.....	June 11, 1880.....	17
Scott, William Sanders.....	Pennsylvania.....	June 11, 1881.....	16
Shindell, James Elliott.....	Pennsylvania.....	June 13, 1881.....	17
Shipley, Richard Trenton.....	Missouri.....	Feb. 3, 1881.....	16
Slade, Thomas Bog.....	Georgia.....	June 11, 1881.....	17
Sloan, Albert Brown.....	Missouri.....	Sept. 22, 1880.....	17
Slocum, George Ralph.....	Illinois.....	Sept. 22, 1881.....	17
Stearns, John Warren.....	New Hampshire.....	Sept. 21, 1881.....	17
Tarbox, Glennie.....	South Carolina.....	Sept. 22, 1881.....	17
Tennant, George Boyce.....	Michigan.....	Sept. 22, 1881.....	17
Thompson, Alexander.....	New York.....	Sept. 23, 1881.....	17
Tilden, Edward Woodruff.....	Ohio.....	June 13, 1881.....	17
Treadway, Henry Wake.....	Illinois.....	Feb. 3, 1881.....	16

FOURTH CLASS.

23

CADET-MIDSHIPMEN.

Fourth class—48 members—Continued.

Name.	State.	Date of admission.	Age at date of admission.		Sea-service in practice-ships.	
			Years.	Months.	Months.	Days.
en, Jerome	New York	June 11, 1881	16	6	2	17
in Whitaker	North Carolina	Sept. 22, 1880	16	11	2	17
benjamin	Tennessee	Sept. 21, 1881	16	2	0	0

Graduat

Order of general merit.	Name.	State.	Date of admission.
1	Whitham, Jay Manuel	Illinois	Sept. 13, 1877
2	Kaemmerling, Gustave	Indiana	Sept. 13, 1877
3	Shallenberger, Oliver Blackburn	Pennsylvania	Sept. 13, 1877
4	Byrne, James Edwin	Massachusetts	Sept. 14, 1876
5	Dowst, Frank Butland	Massachusetts	Sept. 13, 1877
6	McAlpine, Kenneth	Virginia	Sept. 13, 1877
7	Smith, William Stuart	New York	Sept. 13, 1877
8	Webster, William Townsend	New York	Sept. 13, 1877
9	Bankson, Lloyd	Pennsylvania	Sept. 13, 1877
10	Mathews, Clarence Herbert	Ohio	Sept. 14, 1876
11	Redgrave, De Witt Clinton	Maryland	Sept. 13, 1877
12	Stewart, Robert, Jr.	Michigan	Sept. 13, 1877
13	Parsons, Isaac Brown	Michigan	Sept. 13, 1877
14	White, William Wilmet	Pennsylvania	Sept. 13, 1877
15	Sampson, Bias Clay	Illinois	Sept. 13, 1877
16	Perkins, Lyman Burnham	Connecticut	Sept. 13, 1877
17	Belden, Charles Emery	Ohio	Sept. 14, 1876
18	Arnold, Solon	Maryland	Sept. 14, 1876
19	Bush, Arthur Richmond	Massachusetts	Sept. 13, 1877
20	Anderson, Martin Augustus	Wisconsin	Sept. 13, 1877
21	Hogan, Thomas Joseph	Georgia	Oct. 1, 1874
22	Gartley, William Henry	Pennsylvania	Sept. 13, 1877
23	Moritz, Albert	New York	Sept. 13, 1877
24	Beach, Robert James	New York	Sept. 13, 1877

ENGINEERS.

161—24 members.

Order of merit in—										Number of demerits.	Sea-service in practice-ships.		Order of general merit.
S	Steam-engineering.			Electricity.	Physical measurements.	Applied mechanics.	Naval architecture and method of least squares.	Naval architecture (elective).	French and Spanish.		Months.	Days.	
	Mechanical drawing and fabrication.	Designing machinery and marine engines.	Boilers.										
1	3	1	1	2	3	1	1	1	18	54	5	15	1
15	7	3	4	5	3	2	2	2	4	90	5	15	2
5	1	10	2	4	1	14	13	.....	9	128	5	15	3
8	5	9	10	3	10	5	4	3	6	132	5	8	4
7	10	2	5	9	17	10	10	8	5	131	5	8	5
8	12	11	10	8	5	6	3	5	1	173	5	15	6
13	8	4	3	1	2	11	6	7	21	88	8	2	7
3	2	7	5	14	15	16	9	.....	15	104	5	8	8
2	14	12	8	11	10	12	18	.....	17	81	5	15	9
5	15	4	13	6	19	3	5	5	6	89	5	4	10
22	12	17	11	16	10	13	12	10	16	104	8	2	11
18	20	19	18	12	10	15	7	10	8	68	5	0	12
11	4	15	9	22	5	16	19	.....	23	158	5	15	13
15	15	8	15	9	22	6	11	9	23	128	5	15	14
21	18	16	20	19	22	4	8	3	20	121	5	15	15
12	6	4	7	18	19	19	13	.....	11	148	5	8	16
20	21	13	16	7	10	9	17	12	10	47	5	3	17
10	23	20	14	14	18	8	16	12	3	102	8	2	18
4	9	13	21	16	5	21	15	.....	25	160	5	8	19
15	11	17	12	20	15	22	21	.....	13	151	5	15	20
19	17	23	19	13	22	23	20	.....	14	173	5	6	21
14	22	22	22	23	5	16	24	.....	22	153	5	15	22
24	24	21	23	21	5	22	21	.....	12	147	5	8	23
25	25	24	24	24	21	22	21	.....	19	152	5	8	24

Order of annual merit.

	Name.	State.	Date of admission.
19	Addicks, Walter Roberts.....	Pennsylvania.....	Oct. 1, 1878
7	Chambers, William Henry.....	Pennsylvania.....	Oct. 1, 1878
10	Clarke, Arthur Henry.....	Rhode Island.....	Oct. 1, 1878
22	Coley, Frederick Edward.....	New York.....	Oct. 1, 1878
11	Conant, Frank Henry.....	Massachusetts.....	Oct. 1, 1878
*3	Creighton, William Henry Paul.....	Ohio.....	Oct. 1, 1878
17	Day, Willis Bunker.....	Ohio.....	Sept. 13, 1877
*4	Ferguson, George Robert.....	Connecticut.....	Oct. 1, 1878
6	Flitts, James Henry.....	Virginia.....	Oct. 1, 1878
*2	Gatewood, Robert Woodland.....	Virginia.....	Oct. 1, 1878
9	Gantner, Otto Charles.....	New Jersey.....	Oct. 1, 1878
16	Hawthorne, Harry Leroy.....	Kentucky.....	Oct. 1, 1878
15	Higgins, Robert Barnard.....	Maryland.....	Oct. 1, 1878
20	Howland, Charles Henry.....	Rhode Island.....	Oct. 1, 1878
13	Leonard, John Calvin.....	Ohio.....	Oct. 1, 1878
23	Leopold, Harry Girard.....	Ohio.....	Oct. 1, 1878
18	McAllister, Andrew.....	New York.....	Sept. 13, 1877
*5	Miller, Peter.....	Kansas.....	Oct. 1, 1878
12	Pendleton, Joseph Henry.....	Pennsylvania.....	Oct. 1, 1878
8	Rommell, Charles Edward.....	Pennsylvania.....	Oct. 1, 1878
*1	Theiss, Emil.....	Wisconsin.....	Oct. 1, 1878
14	Willis, Clarence Calhoun.....	Mississippi.....	Oct. 1, 1878
21	Winchell, Ward Philo.....	Ohio.....	Oct. 1, 1878

ENGINEERS.

members.

Order of merit in—									Sea-service in practice- ships.			
Mechanical drawing.	Fabrication of machinery.	Designing of machinery.	Astronomy.	Physics and chemistry.	Heat and light.	Mechanics and calculus.	English and history.	French.	Number of demerits.	Months.	Days.	Order of annual merit.
13	14	14	14	22	15	21	7	23	106	7	18	19
3	9	5	9	9	5	7	2	8	81	7	18	7
21	25	15	7	16	9	9	5	5	109	7	18	10
19	23	18	18	24	20	23	20	21	219	7	18	22
17	5	13	13	11	13	20	15	12	185	7	18	11
4	6	8	6	3	3	5	1	4	71	7	18	*3
15	4	12	19	18	22	19	10	18	87	8	2	17
1	3	6	5	6	7	4	16	6	43	7	18	*4
6	16	7	8	5	6	6	7	2	143	7	18	6
2	15	1	8	2	2	1	4	3	181	7	18	*2
11	1	9	15	7	10	11	17	7	100	7	18	9
7	16	20	12	13	17	15	18	19	151	7	18	16
8	7	23	16	8	10	17	23	15	124	7	18	15
18	24	19	20	23	20	18	12	17	180	7	18	20
23	20	16	3	16	12	16	14	14	122	7	18	13
20	8	8	23	14	17	10	25	24	204	7	18	23
15	16	21	22	14	24	14	7	20	112	7	18	18
10	12	3	2	4	4	3	6	10	146	7	18	*5
25	13	11	17	10	16	12	18	13	184	7	18	12
8	19	9	10	12	8	8	10	11	87	7	18	8
5	3	2	1	1	1	2	2	1	168	7	18	*1
22	11	22	11	19	14	12	13	8	196	7	18	14
12	9	16	21	20	23	23	23	16	193	7	18	21

Order of annual merit.	Name.		State.	Date.
*5	Aldrich, William Sleeper	New Jersey	Oct	
*1	Armistead, Samuel Wilson	Virginia	Oct	
12	Barnes, Charles Edwin	New Jersey	Oct	
*2	Baxter, William Joseph	Ohio	Oct	
19	Carswell, William Beggs	Delaware	Oct	
10	Darrah, William Francis	Rhode Island	Oct	
25	Duvall, Marius, jr	Maryland	Oct	
8	Dyson, Charles Wilson	Pennsylvania	Oct	
*3	Eaton, Charles Phillips	Wisconsin	Oct	
21	Ellenger, Julius	Maryland	Oct	
*6	Ellicott, John Morris	Maryland	Oct	
13	Field, Harry Ashby	Virginia	Oct	
16	Gillis, Harry Alexander	Pennsylvania	Oct	
24	Glascok, Eustace Straughn	Maryland	Oct	
14	Gross, Charles Jacob	Maryland	Oct	
11	Halstead, Alexander Seaman	Pennsylvania	Oct	
17	Herbert, William Cromwell	Pennsylvania	Oct	
22	Lawrance, William Hunter	Pennsylvania	Oct	
*7	Littlehales, George Washington	Pennsylvania	Oct	
20	Palmer, James Edward	North Carolina	Oct	
15	Quinby, Isaac Henry	New York	Oct	
23	Ryan, Philip Joseph	New York	Oct	
†	Shock, Thomas Alexander Wharton	Maryland	Oct	
18	Webster, Charles Franklin	Pennsylvania	Oct	
*4	Woodruff, Charles Edward	Pennsylvania	Oct	
	Zinnell, George Frederick	Pennsylvania	Oct	

† Turn

ENGINEERS.

members.

Years.	Months.	Mathematics.	Mechanical drawing and fabrication of machinery.	Elementary physics.	History and rhetoric.	French.	Number of demerits.	Sea-service in practice-ships.		Order of annual merit.
								Months.	Days.	
16	6	5	1	2	11	15	52	4	0	*5
18	0	1	2	6	3	8	61	4	0	*1
17	8	14	9	12	8	11	100	4	0	12
20	11	2	6	2	1	4	66	4	0	*2
18	10	17	17	23	14	22	150	4	0	19
17	1	10	8	5	6	3	153	3	17	10
20	3	23	20	25	24	24	249	4	0	25
17	9	6	18	8	9	9	149	4	0	8
16	4	3	10	7	10	1	95	4	0	*3
16	11	21	21	14	17	20	195	4	0	21
20	0	6	8	11	4	6	71	4	0	*6
17	2	12	10	19	15	17	21	4	0	13
17	9	19	12	24	13	18	187	4	0	16
16	6	25	25	22	21	21	248	4	0	24
17	11	13	5	21	16	9	89	4	0	14
17	9	11	19	9	11	18	144	4	0	11
15	6	15	23	17	17	16	228	4	0	17
20	11	22	13	17	22	24	131	4	0	22
18	11	9	14	4	2	5	40	4	0	*7
18	3	19	7	16	25	23	67	4	0	20
17	7	16	15	13	20	2	249	6	16	15
19	11	24	24	20	23	19	225	4	0	23
18	4							5	1	†
17	8	17	22	15	17	13	232	4	0	18
18	11	4	4	1	5	7	147	4	0	*4
17	11	8	16	10	7	12	108	4	0	9

present first class.

CADET-ENGINEERS.

Third class—26 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of in-	
				Years.	Months.	Mathematics.	Mechanical drawing.
7	Baron, Charles Christopher	Mass..	Oct. 1, 1880	19	0	8	11
*3	Biddle, Andrew Porter	Mich..	Oct. 1, 1880	18	7	6	22
*1	Capps, Washington Lee	Va....	Oct. 1, 1880	16	8	1	12
14	Crisp, Richard Owens	Md....	Oct. 1, 1880	18	9	4	14
9	Dargan, Milton	S. C....	Oct. 1, 1880	18	7	9	16
18	Davis, Edward	Penn..	Oct. 1, 1880	20	8	10	5
13	Fahs, Charles Marion	Ala....	Oct. 1, 1880	17	9	13	22
16	Field, Horace Almeron	N. Y....	Oct. 1, 1880	19	3	14	13
6	Hewes, Charles Hinman	Penn..	Oct. 1, 1880	16	4	3	7
12	Hill, Frank Kinsey	Ohio..	Oct. 1, 1880	19	6	10	8
8	Hughes, Arthur Lewis	Ohio..	Oct. 1, 1880	19	9	12	25
4	Hulme, Walter Oliphant	N. J....	Oct. 1, 1880	20	10	7	4
20	Jones, Horace W	Va....	Oct. 1, 1880	19	1	18	14
21	Keilholtz, Pierre Otis	Md....	Oct. 1, 1880	18	5	20	3
*2	Knepper, Chester Mahlon	Penn..	Oct. 1, 1880	18	9	2	21
11	Loomis, Frederic James	Conn..	Oct. 1, 1880	18	0	11	2
19	McCay, Henry Kent	Ga....	Oct. 1, 1880	20	5	15	17
22	Mathews, Albert Clifton	Ohio..	Oct. 1, 1880	18	10	23	6
26	Orr, Robert Hunter	Del....	Oct. 1, 1880	20	0	26	26
5	Parmenter, Henry Earl	R. I....	Oct. 1, 1880	19	6	4	1
24	Pattison, Thomas Putnam	Md....	Oct. 1, 1879	19	6	22	10
25	Richardson, Thornton Russell ...	Penn..	Oct. 1, 1880	20	1	25	24
23	Starr, John Barton	Kans..	Oct. 1, 1880	19	2	24	17
10	Wedderburn, Lawrence Alexander	Va....	Oct. 1, 1880	18	0	17	9
17	Wernitz, Robert Lincoln	Penn..	Oct. 1, 1880	19	4	21	19
15	Whittlesey, Humes Houston	Ind....	Oct. 1, 1880	19	1	16	20

CADET-ENGINEERS.

Fourth class—25 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
ison Augustus	Pennsylvania	Oct. 1, 1881	16	8	21
Thomas	Delaware	Oct. 1, 1881	17	10	1
ansdale	Maryland	Oct. 1, 1881	18	11	4
Ogle	Louisiana	Oct. 1, 1881	20	2	7
m Wesley	Illinois	Oct. 1, 1881	21	7	24
s Matthias	Maryland	Oct. 1, 1881	19	11	14
lbert Christian	Pennsylvania	Oct. 1, 1881	18	9	23
Robert	Massachusetts	Oct. 1, 1881	18	7	12
ore Cornell	Pennsylvania	Oct. 1, 1881	18	8	8
r Waller	Tennessee	Oct. 1, 1881	19	1	22
Washington	New Jersey	Oct. 1, 1881	17	9	15
Charles Monod	Virginia	Oct. 1, 1881	19	6	19
nes Francis	Maryland	Oct. 1, 1881	18	11	20
m	Pennsylvania	Oct. 1, 1881	16	9	11
i Gardner	Virginia	Oct. 1, 1881	16	9	9
r Boone	New Jersey	Oct. 1, 1881	19	1	13
ld	Virginia	Oct. 1, 1881	19	3	3
m	Virginia	Oct. 1, 1881	18	10	6
Charles Semmes	Virginia	Oct. 1, 1881	17	2	16
les Wallace	Maryland	Oct. 1, 1881	19	9	25
h	Virginia	Oct. 1, 1881	19	10	26
n Godwin	Delaware	Oct. 1, 1881	19	8	10
Watson	Virginia	Oct. 1, 1881	17	7	2
ston Henry	Pennsylvania	Oct. 1, 1881	18	11	5
s Edwin	Maryland	Oct. 1, 1881	17	3	17

SUMMARY.

October 1, 1881.

CADET-MIDSHIPMEN.

.....	37 members.
.....	38 members.
.....	38 members.
.....	48 members.
.....	161

CADET-ENGINEERS.

.....	23 members.
.....	26 members.
.....	26 members.
.....	25 members.
.....	100
.....	281

DEATHS, RESIGNATIONS, AND DISMIS

November 2, 1880, to November 4, 1881.

DIED.

Cadet-Midshipman Charles J. Dudley	Nov
Cadet-Engineer William Lang	(at Buffalo, N. Y.)..Nov
Cadet-Midshipman Edmund E. Kiefer	Nov
Cadet-Midshipman Byron G. Pierce	Nov
Cadet-Engineer Edward K. Taylor	Dec
Cadet-Midshipman James J. G. Cooper	(at Washington, D. C.)..Sept

DISMISSED.

Cadet-Midshipman Frank F. E. Lodeman	May
Cadet-Midshipman Stephen Ashby	May
Cadet-Engineer Herman Eckel	June

DROPPED.

Cadet-Midshipman William A. Gresham	June
Cadet-Midshipman William W. Russell	June
Cadet-Midshipman Max A. Orlopp	June
Cadet-Midshipman Edward N. Bell	June
Cadet-Midshipman John J. Conway	June
Cadet-Midshipman Thomas W. Hayden	June
Cadet-Midshipman Charles R. Reynolds	June
Cadet-Midshipman William W. Ricketts	June
Cadet-Midshipman Edwin G. Temple	June
Cadet-Midshipman Edward R. Cassidy	June
Cadet-Midshipman William G. Ganong	June
Cadet-Midshipman Arlington L. Lovenskiold	June
Cadet-Midshipman Charles Venable	June
Cadet-Midshipman James F. Carpenter	Oct.
Cadet-Engineer Daniel E. Gladstone	Oct.

RESIGNED.

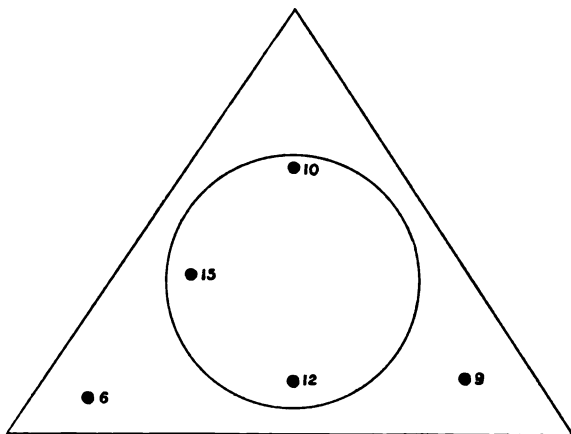
Cadet-Midshipman John H. Lindsey	Nov.
Cadet-Midshipman Walter E. Morris	Nov.
Cadet-Midshipman James W. Smythe	Nov.
Cadet-Midshipman Charles R. Mitchell	Jan.
Cadet-Midshipman Foxhall A. Parker	Jan.
Cadet-Midshipman Edward E. Solomon	Mar.
Cadet-Engineer Henry L. Simpson	Mar.
Cadet-Midshipman Michael E. Lennon	Sept
Cadet-Midshipman Charles T. Phythian	Oct.

WITHDRAWN.

Japanese Student Sadanori Youchi	Apr
--	-----

TARGET PRACTICE—GREAT GUNS.

NNERY-SHIP SANTEE, ANNUAL EXAMINATION, 1881.—CADET-MIDSHIPMEN,
CLASS OF 1881.

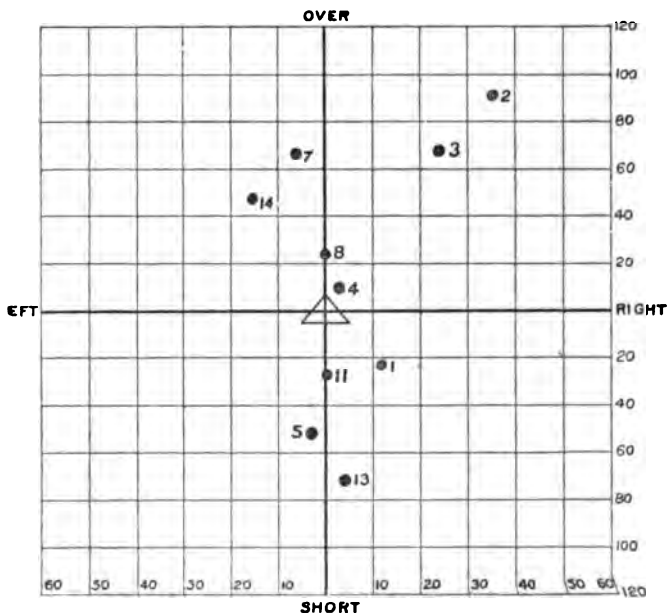


ge E. Perry; 9. Samuel Bryan; 10. Eugene Carroll; 12. H. C. Haines; 15. W.
Number 6 struck the target on ricochet; numbers 12 and 15 carried away

12 feet in width and 9 feet high; gun, 8-inch S. B.; projectile, shell; dia-
00 yards; fuse, $3\frac{1}{4}$ seconds. Whole number of fires, 15; number of hits, 5.

Rectangle of fire—Distances in yards.

[Light breeze from the right across the line of fire.]



3 N A E

SUMMER CRUISE, 1881.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION

Commander F. V. McNAIR, *Commanding*.
Lieutenant-Commander C. M. THOMAS, *Executive Officer*.
Lieutenant J. W. MILLER, *Navigator*.
Lieutenant D. DELEHANTY, *Watch Officer*.
Lieutenant M. F. WRIGHT, *Watch Officer*.
Lieutenant C. P. REES, *Watch Officer*.
Master C. W. BARTLETT, *Watch Officer*.
Lieutenant H. W. SCHAEFER, *Instructor in Navigation*.
Paymaster L. G. BILLINGS.
Surgeon J. G. AYERS.
Passed Assistant Surgeon A. G. CABELL.
Chaplain J. S. WALLACE.

Cadet-Midshipman A. R. Hasson.

CADET-MIDSHIPMEN.

First class (36).

Anderson, E. A.	Fowler, H.	Kent, G. E.	Pat
Arnold, J. T.	Grambs, W. J.	Key, A. L.	Poy
Bennett, L. S.	Gwyn, L. S.	King, W. N.	Pri
Blandin, J. J.	Horst, H. A.	McGiffin, P. N.	Sav
Doyle, J. G.	Howard, W. L.	McNutt, F. A.	Sen
Duncan, W. B.	Hubbard, N. M.	McWhorter, J. G.	Sta
Eames, H. H.	Jayne, J. L.	Martin, C.	Sat
Field, W. R. M.	Johnston, M.	Nixon, L.	Wh
Fletcher, W. B.	Kenkel, H. H.	Paine, W. T.	Wo

Third class (38).

Barker, W. A.	Curtis, F. E.	Hazeltine, C. W.	Lea
Beecher, A. M.	Davis, J. S.	Hoggatt, W. B.	Met
Bush, W. W., jr.	Friedlander, H.	Jastremski, L. H.	Met
Carter, V.	Harrell, J. R.	Jones, H. P., jr.	Met
Cook, W. E.	Hayes, C. H.	Johnston, W.	Me

A. E.	Moseley, N. S.	Smith, S. F.	Welles, R., jr.
J. S.	O'Malley, W. A.	Sparling, F. H.	Williams, C. S.
H.	Plunkett, C. P.	Stevens, R. R. W. B.	Williams, W. P.
on, V.	Seymour, I. K.	Terrell, D. F.	Wirt, W. E.
. W.	Shoemaker, W. R.		

Fourth class (6).

J. C.	Lamison, J. G.	Sargent, F. H.	Sloan, A. B.
V. W.	Raichle, F. G.		

Constellation sailed from Annapolis Roads June 16, and entered Buzzard's Bay from thence proceeded to Newport, R. I., and returned to Buzzard's Bay.

16 sailed for Chesapeake Bay, and anchored off the Naval Academy on the 27 of August 27, 1881.

UNITED STATES PRACTICE-SHIP DALE.

Commander P. F. HARRINGTON, *Commanding*.

Lieutenant A. WALKER, *Executive Officer*.

Lieutenant E. D. TAUSSIG, *Navigator*.

Lieutenant A. McCrackin, *Watch Officer*.

Lieutenant J. B. MURDOCK, *Watch Officer*.

Lieutenant H. L. GREEN, *Watch Officer*.

T. B. HOWARD, *Watch Officer*.

Paymaster J. R. MARTIN.

Assistant Surgeon W. H. RUSH.

CADET-MIDSHIPMEN.

Second class (41).

P.	Dovalé, A.	Legaré, A. B.	Stout, G. C.
r, R. C.	Frazier, R. T.	Lennon, M. E.	Street, G. W.
I. H.	George, H.	Lerch, R. L.	Sweeting, C. E.
R. W.	Gignilliat, T. H.	Megrath, W. A.	Thurston, B. E.
J. H.	Gray, W. T.	Mitchell, S. Z.	Toney, T. V.
. W. E.	Greene, S. D., jr.	O'Leary, T. S.	Von Schrader, G. M.
T.	Jackson, J. A.	Pettit, H. C.	Weeks, E. B.
r, J. F.	Jackson, J. B.	Philbin, P. H.	Wilson, W. J.
F. L.	Keith, A. S.	Phythian, C. T.	Witherspoon, T. A.
. R.	Ledbetter, W. H.	Smith, T. B.	Woods, R. H.
le, E. W.			

Fourth class (15).

J. A. P.	Gibson, R. E. L.	Scott, W. S.	Tilden, E. W.
. D.	Jacobs, B.	Shindel, J. E.	Treadway, H. B.
g, C. M.	Nes, D. S.	Shipley, R. T.	Van Keuren, J.
, J. C. P.	Russell, R. L.	Slade, T. B.	

Dale sailed from Annapolis Roads June 18, and touched at Hampton Roads; then proceeded to Buzzard's Bay, and joined the Constellation June 30; from there to Newport, R. I.; returned to Buzzard's Bay.

Dale 15 sailed for the Chesapeake, and anchored off the Naval Academy on the 27 of August 27, 1881.

UNITED STATES PRACTICE-STEAMER STANLEY

Lieutenant-Commander S. H. BAKER, *Commanding.*Lieutenant B. F. TILLEY, *Executive Officer.*

Assistant Paymaster T. J. COWIE.

Passed Assistant Engineer W. A. WINDSOR.

Assistant Engineer G. B. RANSOM.

CADET-ENGINEERS.

First class (24).

Addicks, W. R.	Day, W. B.	Hawthorne, H. L.	Miller, F.
Chambers, W. H.	Ferguson, G. R.	Higgins, R. B.	Pendleton
Clarke, A. H.	Fitts, J. H.	Howland, C. H.	Kommell
Coley, F. E.	Gatewood, R. W.	Leonard, J. C.	Theiss, F.
Conant, F. H.	Gladstone, D. D.	Leopold, H. G.	Willis, C.
Creighton, W. H. P.	Gsantner, O. C.	McAllister, A.	Winchell

UNITED STATES PRACTICE-STEAMER MAYFLOW

Lieutenant-Commander JOHN SCHOUER, *Commanding.*Lieutenant F. G. HYDE, *Executive Officer.*

Assistant Paymaster R. T. M. BALL.

Passed Assistant Surgeon L. B. BALDWIN.

Passed Assistant Engineer J. S. OGDEN.

Cadet-Engineer S. ARNOLD.

Cadet-Engineer W. S. SMITH.

Cadet-Engineer D. W. C. REDGRAVE.

CADET-ENGINEERS.

Second class (25).

Aldrich, W. S.	Dyson, C. W.	Glasscock, E. S.	Palmer,
Armistead, S. W.	Eaton, C. P.	Gross, C. J.	Quinby,
Barnes, C. E.	Ellenger, J.	Halstead, A. S.	Ryan, P.
Baxter, W. J.	Ellicott, J. M.	Herbert, W. C.	Webster,
Carswell, W. B.	Field, H. A.	Lawrance, W. H.	Woodruff
Darrah, W. F.	Gillis, H. A.	Littlehales, G. W.	Zinnell,
Duvall, M., jr.			

The practice-steamer Standish, accompanied by the Mayflower, steamed from the Naval Academy June 14, and touched at Washington, D. C., Norfolk, Va., Edgemoor, Del., Wilmington, Del., Chester, Pa., Philadelphia, Pa., West Point, N. Y., Cold Spring, N. Y., Newburg, N. Y., Newport, R. I., Rocky Point, R. I., Providence, R. I., and Boston, Mass., visiting the different navy-yards, work and machine shops, iron foundries, etc., at the above-named places; and returned and anchored off the Naval Academy August 27, 1881.

TABLE OF COEFFICIENTS.

Department.	Subject.	Cadet-Midshipmen.						C
		Fourth class.	Third class.	Second class.	First class.	Gratuifying maxima for required studies.	Maxima for final examination.	
Seamanship.	Seamanship			10	16		48	
	Naval Tactics			2			12	
	Ship-building				4	128		
	Aptitude						12	
Ordnance and Gun- nery.	Gunnery						48	
	Ordnance Instructions and Infantry Tactics			5				
	Ordnance and Armor				14	76		
Mathematics.	Algebra and Geometry	8						9
	Trigonometry		8					
	Analytical Geometry		7					
	Descriptive Geometry		4			108		
Steam-Engineering.	Steam-Engineering						48	
	Mechanical Drawing							} 2
	Fabrication of Machinery ..							
	Designing Machinery							
	Marine Engines				13	53		
Astronomy, Naviga- tion, and Surveying.	Boilers							
	General Astronomy			6				
	Theoretical Navigation				8			
	Practical Navigation				} 9	} 48		
	Surveying and Compass De- viations						92	
Physics and Chemis- try.	Physics and Chemistry		6	5				
	Light and Heat			5				
	Electricity				6	88		
	Physical Measurements							
Mechanics and Ap- plied Mathematics.	Mechanics and Calculus			14				
	Applied Mechanics							
	Naval Architecture and Method of Least Squares ..							
	Elective Course in Naval Architecture				12	56		
English Studies, His- tory, and Law.	English and History	5		5				2
	History and Rhetoric		6					
	Public Law				3	76		
Modern Languages.	French	3	5	5	3	64	24	2
Drawing.	Drawing	3	2			20		
Maximum for each year, exclusive of electives		76	152	228	304	760	240	76
Deduction for each demerit		.004	.007	.013	.030			.004

MERIT-ROLLS FOR, 1880-81.

Merit-rolls, made out annually for each class, show the proficiency of the cadets in each branch of study. The numbers given in the preceding table, showing the relative weight of the different branches, are used as coefficients; the final mark in each branch (on a scale of 4) being multiplied by the number assigned to that branch. The sum of the products, after making deductions for conduct, is the final mark of the cadet for the year.

In the case of cadets who take an elective course in any branch, the final mark in that branch is determined by adding to the final mark received in the required course one-fifth of the amount by which the final mark in the elective course exceeds 2.50.

In the graduating merit-roll, the final mark for the course is determined by the sum of the four yearly marks.

"Cadets who attain 85 per cent. of the multiple in any year shall be distinguished by a star affixed to their names on the merit rolls."—(Regulations U. S. Naval Academy, § 150.)

Cadets whose names are marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked (§) were found deficient, and recommended to be dropped.

(a) denotes absence from examination.

MIDSHIPMEN.
Class of 1879 (37 members). Final examination, June, 1881.

Order of merit.	Name.	Final aggregate.									
		Seamanship.	Naval tactics.	Gunnery.	Navigation.	Steam-engineering.	French.	Aptitude.	Aggregate for examination.	General aggregate for four years.	1000
	Maxima for this class	48	12	48	48	48	24	12	240	760	
1	Randolph H. Miner.....	46.68	11.58	43.20	43.80	42.00	22.20	9.90	219.36	673.62	892.98
2	John Hood.....	41.82	10.20	41.76	44.40	38.76	19.20	8.40	204.24	667.13	871.37
3	Edward E. Hayden.....	41.76	8.22	38.76	37.32	42.00	20.52	8.10	196.68	654.09	850.77
4	Abner B. Clements.....	42.36	10.92	33.12	37.92	41.40	37.40	8.70	191.82	655.49	847.31
5	Henry S. Chase.....	43.80	10.20	37.92	33.48	40.20	21.12	11.40	198.12	638.16	836.28
6	Leroy M. Garrett.....	33.24	9.51	41.88	40.44	37.80	21.42	9.09	193.29	614.46	807.75
7	Charles C. Marsh.....	39.36	10.20	41.88	38.52	36.00	21.30	10.20	197.46	601.42	798.88
8	John B. Blish.....	47.04	10.56	35.96	39.96	41.76	19.92	9.60	205.80	586.42	792.22
9	Robert S. Sloan.....	42.96	8.40	37.92	38.16	36.60	15.00	12.00	191.94	592.38	784.32
10	Charles W. Jungen.....	39.72	9.00	36.60	35.88	41.40	20.40	11.70	194.70	589.23	783.93
11	Charles H. Harlow.....	45.00	9.00	36.48	36.12	36.60	20.10	10.50	194.40	584.40	772.80
12	William A. Gill.....	44.16	10.26	40.20	34.62	41.40	18.30	7.50	196.74	579.63	770.37
13	Bennett P. Schwin.....	46.92	10.32	34.80	27.00	41.16	10.20	11.40	191.76	571.78	763.54
14	Charles S. Ripley.....	40.68	9.81	37.20	31.68	37.20	18.60	7.50	182.67	556.68	739.35
15	Leigh O. Garrett.....	45.36	11.07	35.04	30.36	39.36	16.02	9.00	186.21	552.13	738.34
16	Walton J. Sears.....	34.56	10.29	34.56	33.72	41.40	20.10	9.00	184.63	552.40	736.93
17	John Gibson.....	37.80	10.11	32.64	34.56	35.76	20.50	10.20	177.37	555.82	733.39

	41.64	9.00	34.68	33.00	15.50	9.00	185.25	508.57	684.30
26 John A. Mudd	41.64	10.71	34.68	33.00	15.50	9.00	185.25	508.57	684.30
27 Robert F. Lopez	39.90	9.90	33.00	27.00	18.30	7.50	172.08	514.84	687.52
28 Francis W. Kellogg	33.72	7.50	30.48	28.40	18.30	8.40	150.09	528.00	687.09
29 John L. Purcell	39.24	8.97	30.36	31.80	20.40	10.50	171.87	514.51	680.38
30 William A. Thom	35.04	9.24	32.04	27.60	17.10	9.00	161.34	515.77	677.11
31 Percival L. Drayton	38.88	7.50	30.00	24.90	21.90	9.00	155.10	514.69	669.79
† Maurice L. Read	34.80	5.85	27.84	32.40	20.58	9.30	166.53	512.13	678.06
† Reuben O. Bitler	33.72	10.89	23.64	30.60	15.00	9.00	160.77	494.27	645.04
† Andrew C. Cunningham	35.04	9.00	27.60	36.00	18.00	7.50	158.22	521.36	679.58
§ Henry L. Sturdivant	31.08	8.73	26.04	35.16	16.80	4.50	158.91	488.67	647.58
‡ Guy W. Brown	27.96	8.70	28.20	28.76	15.90	7.80	140.52	518.33	658.85
† George S. Welsh	25.56	α	α	31.20	α	α	α	497.63	.....
Albert G. Winterhalter (class of 1877)	32.64	9.47	37.44	37.20	24.00	9.90	189.18	621.83	811.01
Wilson L. Todd (class of 1878)	35.88	9.90	41.04	25.56	15.30	7.50	171.42	536.79	698.21

CADET-MIDSHIPMEN.

Merit-roll of first class (76 members), annual examination, June, 1881, and general merit-roll for four years.

Name.	Manship.	Ship-building.	Ordnance.	Marine engineer.	Theoretical navigation.	Practical navigation and surveying.	Electricity.	Naval architecture.	Public law.	French and Spanish.	Conduct.	Aggregate for four years.				Aggregate for first year.	Aggregate for second year.	Aggregate for third year.	Aggregate for fourth year.	General aggregate for four years.
	64	16	56	52	32	36	24	3,60	12	12		304	228	152	76	76	152	228	304	760
John L. Schock	38.08	14.32	52.50	46.15	29.60	33.66	22.50	3.24	10.74	10.38	0.45	280.72	211.40	143.56	72.03	707.74				
Joseph J. Woodward	38.56	13.84	51.38	48.88	28.72	32.31	22.56	2.76	10.56	10.02	1.17	278.42	205.47	134.04	62.96	680.89				
Joseph H. Linnard	52.64	13.60	50.96	47.58	28.16	34.20	23.40	3.00	10.59	10.38	2.19	272.32	203.30	135.17	64.90	675.68				
John A. Hoogewerff	56.00	12.76	56.82	46.15	27.20	32.58	22.88	2.40	10.86	10.26	2.25	308.04	201.32	132.64	61.63	667.23				
Francis E. Sutton	51.84	14.16	51.80	46.80	28.00	31.68	21.60		11.04	12.18	1.14	267.96	195.27	129.82	61.01	654.16				
John L. Rees	51.68	12.52	49.00	40.95	27.60	30.24	18.90	1.08	10.65	10.02	3.09	248.65	197.38	134.80	60.27	651.16				
Robert B. Desbaillet	60.96	14.56	53.20	43.81	23.76	28.96	18.06		9.87	11.85	0.90	265.25	194.61	127.47	61.80	649.23				
Frederic C. Rider	47.20	12.64	46.90	43.42	26.32	28.08	22.20	0.96	9.51	9.84	3.51	244.50	184.72	134.37	62.61	644.50				
Harry K. White	55.68	14.08	49.14	46.93	26.16	31.56	22.14	1.20	9.90	10.74	0.96	266.60	192.79	125.52	57.77	642.68				
Lincoln Karmun	56.64	12.64	49.56	42.51	27.76	32.22	21.90		10.17	10.92	1.74	262.62	196.50	123.69	59.19	641.40				
Edward E. Caphart	52.28	12.36	49.00	44.46	26.96	30.42	21.24		9.45	11.25	1.65	255.69	187.33	122.45	56.35	623.12				
Eugene Carroll	53.12	12.36	40.76	40.30	25.44	28.70	18.36		9.60	10.20	3.09	242.84	185.52	124.04	62.23	615.63				
Houston Eldridge	50.80	14.52	48.44	40.43	21.48	27.00	15.60		9.06	9.84	1.89	247.56	180.56	118.24	62.01	608.29				
Frederic S. Wells	40.12	11.04	45.08	31.71	25.44	28.17	19.92	0.96	9.00	8.43	2.64	239.32	180.28	120.92	63.30	599.47				
Frank E. Bunde	55.68	11.76	46.16	40.65	22.60	27.81	17.64		10.29	10.71	0.90	241.16	183.11	116.32	55.53	598.12				
Charles H. Lamberton	51.68	11.56	45.64	42.51	24.48	28.25	20.10		10.47	11.13	2.55	243.43	174.60	114.73	56.36	597.15				
Robert F. Lamberton	51.51	11.40	42.16	41.16	23.08	29.07	18.24		10.62	10.20	1.64	246.91	176.22	114.97	64.96	587.16				

(Order of general merit.)

	32.44	12.68	44.88	88.88	28.18	44.40	8.48	9.63	8.48	118.00	118.00	118.00	88.88	88.88
24 Franklin J. Moses.....	49.44	11.68	43.82	40.00	25.44	27.63	20.58	.....	.....	172.00	118.00	118.00	53.17	578.97
25 Gilbert Wilkes.....	50.72	14.64	46.76	41.86	23.20	29.10	17.98	.....	0.54	175.15	102.85	102.85	48.29	571.30
26 Sotokichi Urie.....	51.84	11.16	40.88	38.40	24.80	26.91	17.40	.....	0.51	164.15	117.22	117.22	58.89	570.45
27 Henry C. Haines.....	48.48	12.76	41.24	37.18	22.24	28.64	16.38	.....	0.96	167.78	116.27	116.27	62.56	568.90
28 George P. Blow.....	50.48	14.00	50.12	40.43	21.76	23.11	15.12	.....	0.87	171.10	105.03	105.03	52.08	567.49
29 George Barnett.....	53.76	12.52	44.48	39.20	22.16	26.01	18.06	.....	0.60	171.03	110.72	110.72	50.77	567.15
30 Con M. Perkins.....	47.68	12.44	43.96	35.36	20.80	23.94	16.14	.....	0.10	169.25	123.06	123.06	54.88	565.16
31 William F. Plourney.....	47.36	11.12	42.28	37.83	21.68	26.37	18.00	.....	0.78	166.41	109.74	109.74	57.71	555.78
32 Frederick W. Smith.....	45.60	12.16	44.60	37.44	21.12	25.56	15.78	.....	0.49	168.97	113.11	113.11	55.07	555.40
33 James H. Colwell.....	47.52	11.96	46.24	41.34	23.76	25.83	17.22	.....	0.36	163.94	107.11	107.11	53.17	555.11
34 Henry L. Ballentine.....	48.88	11.64	43.12	36.60	21.60	25.11	16.02	.....	0.99	167.64	107.25	107.25	57.76	554.84
35 George Clarke.....	50.88	12.08	43.12	40.30	27.04	29.43	17.76	.....	0.75	159.40	108.49	108.49	50.94	554.50
36 William M. Robinson.....	50.08	11.84	43.20	39.76	22.96	26.82	17.10	.....	0.78	163.15	103.17	103.17	53.85	552.81
37 Guy M. Buck.....	51.84	11.60	44.56	37.37	24.04	27.81	17.22	.....	0.42	164.70	107.28	107.28	48.35	551.97
38 Samuel Bryan.....	53.28	10.84	44.24	38.74	22.32	25.47	16.38	.....	0.27	160.14	104.97	104.97	50.90	551.84
39 John W. Weeks.....	49.92	11.84	48.44	39.52	24.16	26.82	16.98	.....	0.96	164.27	104.16	104.16	49.82	551.53
40 Edward H. Harrison.....	49.60	11.12	39.90	41.08	20.56	25.11	16.26	.....	0.52	173.27	106.10	106.10	52.77	550.80
41 Charles P. George.....	50.88	11.88	44.24	37.18	25.30	25.36	16.08	.....	0.30	163.54	105.02	105.02	55.52	550.54
42 Orington E. Weller.....	49.60	10.52	43.68	36.40	24.56	27.54	16.48	.....	0.21	163.50	102.18	102.18	51.40	549.63
43 Harry R. Cohen.....	52.16	12.36	48.10	38.09	20.48	24.06	15.42	.....	0.11	163.30	102.58	102.58	52.43	548.31
44 Charles W. Stewart.....	48.32	10.28	41.20	38.61	22.88	27.27	16.02	.....	0.33	161.80	109.26	109.26	54.79	547.99
45 John A. Kimball.....	50.88	11.40	39.76	36.53	22.56	24.06	16.74	.....	0.73	167.37	108.55	108.55	50.84	543.51
46 James Davis Crenshaw.....	48.96	12.24	42.84	41.47	21.80	25.40	17.76	.....	0.82	157.37	108.91	108.91	52.43	543.28
47 Ira McJunkin.....	52.16	12.12	46.08	36.92	22.60	23.67	16.62	.....	0.51	161.70	103.02	103.02	50.28	541.65
48 Robert P. Hains.....	47.68	12.00	44.24	39.20	20.72	24.21	15.06	.....	0.91	160.41	110.42	110.42	51.99	538.95
49 Rudolphus R. Cockle.....	51.52	12.20	41.44	37.31	21.52	24.57	15.42	.....	0.33	160.37	108.72	108.72	54.74	540.21
50 Spencer M. Kase.....	50.56	10.48	40.96	34.07	21.28	23.07	18.06	.....	0.24	160.81	106.16	106.16	51.01	535.24
51 David L. Printup.....	46.72	11.16	42.96	37.93	23.04	24.57	16.62	.....	0.93	158.31	106.08	106.08	58.99	535.19
52 Alexander S. McCrea.....	45.92	11.12	41.72	35.75	20.08	24.03	16.50	.....	0.42	162.15	97.76	97.76	49.81	530.67
53 William G. Ford.....	50.72	10.64	47.04	36.40	21.04	25.29	15.90	.....	0.91	162.15	103.10	103.10	54.31	529.00
54 William LeRoy Emmet.....	47.52	12.12	40.18	38.09	19.68	23.94	18.00	.....	0.22	161.50	98.20	98.20	53.36	528.07
55 Goodenough Craven.....	54.72	11.60	40.04	38.67	18.72	23.53	15.54	.....	0.76	159.13	105.77	105.77	55.30	528.26
56 Gus G. Rodgers.....	48.64	10.28	39.34	36.76	20.56	24.30	15.12	.....	0.72	154.61	103.77	103.77	55.30	528.26

CADET-MIDSHIPMEN.

Merit-roll of first class (75 members), annual examination, June, 1881, and general merit-roll for four years—Continued.

Order of general merit.	Name.	Seamanship.	Ship-building.	Ordnance.	Marine engines.	Theoretical navigation.	Practical navigation and surveying.	Electricity.	Naval architecture (elective).	Public law.	French and Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
	Maxima	64	16	56	52	32	36	24	3.60	12	12		304	228	152	76	760
57	Eugene M. Harmon	50.72	10.16	42.42	34.71	22.08	24.84	15.12	.....	0.03	0.45	4.08	214.45	162.01	99.28	50.40	526.33
58	Michael J. Donnelly	44.80	12.20	42.56	37.96	21.92	24.30	17.40	.....	0.18	10.38	3.42	217.28	137.54	100.71	49.90	525.63
59	James W. Dresser	48.00	10.68	40.74	28.48	21.52	25.02	16.44	.....	0.03	8.37	5.13	212.15	133.54	103.82	53.23	528.74
60	Silas H. Wright	44.00	10.40	41.16	37.18	21.12	23.40	16.20	.....	8.85	8.52	3.75	207.17	147.84	103.97	53.67	514.35
61	Ben Holliday Craig	49.44	10.04	38.64	36.96	20.00	24.03	16.50	.....	0.45	8.94	3.15	210.55	151.91	98.00	53.29	518.62

ORDER OF MERIT IN SEVERAL BRANCHES OF THE SERVICE, 1881.

Order of annual merit.	Name.	Seamanship.		Naval tactics.		Ordnance instructions and infantry tactics.		Astronomy.		Physics and chemistry.		Light and heat.		Mechanics and cal- culus.		English and his- tory.		French.		Conduct.		Aggregate.	
		40	5	20	24	20	20	24	20	20	20	20	20	56	20	20	20	20	20			225	
	Maxima.....																						
1	L. Nixon.....	34.20	7.90	17.15	21.90	19.05	18.55	21.90	19.05	19.05	18.55	18.55	17.70	58.66	17.70	17.15	17.15	17.15	2.11			210.15	
2	S. S. Wood.....	36.90	7.54	18.40	18.80	15.50	16.80	18.80	15.50	15.50	16.80	16.80	15.00	46.28	15.00	15.05	15.05	15.05	0.73			194.14	
3	J. T. Arnold.....	35.30	7.29	13.85	19.56	15.85	16.15	19.56	15.85	15.85	16.15	16.15	15.20	55.86	15.20	13.00	13.00	13.00	2.30			189.67	
4	W. R. Fletcher.....	37.00	7.38	17.00	21.60	16.55	15.45	21.60	16.55	16.55	15.45	15.45	15.85	45.08	15.85	14.55	14.55	14.55	1.14			189.32	
5	E. W. Sutphen.....	37.20	7.00	16.65	19.68	16.30	14.50	19.68	16.30	16.30	14.50	14.50	16.25	44.52	16.25	13.80	13.80	13.80	1.01			184.89	
6	L. S. Bennett.....	36.70	7.40	15.75	18.38	15.70	15.95	18.38	15.70	15.70	15.95	15.95	17.40	43.82	17.40	17.95	17.95	17.95	1.61			182.44	
7	M. Johnston.....	30.30	7.30	14.95	18.60	15.60	14.95	18.60	15.60	15.60	14.95	14.95	15.40	46.06	15.40	16.05	16.05	16.05	1.83			177.38	
8	W. B. Whittelsey.....	34.80	7.48	17.30	19.44	14.55	15.10	19.44	14.55	14.55	15.10	15.10	14.15	42.00	14.15	13.15	13.15	13.15	0.99			176.98	
9	J. L. Jayne.....	33.30	6.76	15.20	21.60	14.25	15.10	21.60	14.25	14.25	15.10	15.10	14.75	41.66	14.75	12.95	12.95	12.95	2.27			176.30	
10	J. G. McWhorter.....	33.20	7.52	16.15	18.30	14.40	15.20	18.30	14.40	14.40	15.20	15.20	14.05	41.10	14.05	13.90	13.90	13.90	2.05			174.77	
11	J. G. Doyle.....	33.20	6.92	16.85	19.62	15.00	14.40	19.62	15.00	15.00	14.40	14.40	13.70	41.44	13.70	12.95	12.95	12.95	1.96			172.52	
12	T. C. Prince.....	31.80	6.54	15.40	18.78	14.00	14.40	18.78	14.00	14.00	14.40	14.40	15.40	38.76	15.40	15.40	15.40	15.40	0.45			171.03	
13	J. J. Blandin.....	30.90	6.84	15.15	16.62	15.45	15.15	16.62	15.45	15.45	15.15	15.15	15.55	38.92	15.55	17.60	17.60	17.60	2.09			170.09	
14	L. R. Savage.....	28.40	6.40	15.05	18.36	15.45	15.70	18.36	15.45	15.45	15.70	15.70	14.85	40.60	14.85	14.45	14.45	14.45	1.12			169.14	
15	W. R. M. Field.....	32.80	6.96	14.60	17.70	14.05	12.90	17.70	14.05	14.05	12.90	12.90	14.05	41.86	14.05	16.50	16.50	16.50	2.53			168.89	
16	E. A. Anderson.....	32.20	6.46	15.50	18.54	14.45	14.35	18.54	14.45	14.45	14.35	14.35	14.30	38.08	14.30	14.35	14.35	14.35	1.60			166.63	
17	W. B. Duncan.....	36.00	7.52	15.95	15.60	12.75	12.80	15.60	12.75	12.75	12.80	12.80	13.70	37.94	13.70	16.45	16.45	16.45	2.44			166.27	
18	A. L. Key.....	29.50	6.72	14.90	16.92	14.05	14.25	16.92	14.05	14.05	14.25	14.25	14.80	42.56	14.80	14.10	14.10	14.10	2.57			165.23	
19	W. L. Howard.....	32.40	6.62	14.70	17.52	13.40	13.45	17.52	13.40	13.40	13.45	13.45	14.10	36.82	14.10	17.30	17.30	17.30	1.40			164.91	
20	L. Sempie.....	29.00	6.80	14.65	17.52	13.50	12.50	17.52	13.50	13.50	12.50	12.50	14.90	40.32	14.90	17.60	17.60	17.60	2.05			164.80	
21	W. T. Paine.....	27.60	5.62	13.60	16.86	13.50	13.10	16.86	13.50	13.50	13.10	13.10	12.90	44.10	12.90	16.85	16.85	16.85	1.05			163.08	
22	J. M. Foyer.....	30.30	6.14	14.55	17.04	13.55	14.35	17.04	13.55	13.55	14.35	14.35	14.60	39.62	14.60	14.10	14.10	14.10	2.22			162.03	

CADET-MIDSHIPMEN.

Merit-roll of second class (34 members), annual examination, June, 1881—Continued.

Order of annual merit.	Name.	Swanship.		Naval tactics.		(Ordnance instructions and infantry tactics).		Astronomy.		Physics and chemistry.		Light and heat.		Mechanics and calculus.		English and history.		French.		Conduct.		Aggregate.	
		40	8	8	8	20	20	24	20	20	20	20	20	56	56	20	20	20	20	20	20	224	224
23	L. S. Gwyn	27.00	7.08	13.20	17.88	13.95	13.95	13.95	13.95	13.95	13.95	13.95	13.95	40.74	40.74	15.05	15.05	14.55	14.55	2.20	2.20	161.20	161.20
24	H. A. Horst	28.30	6.72	13.05	15.00	14.35	14.35	15.00	14.35	14.35	14.35	12.50	12.50	37.10	37.10	15.95	15.95	17.90	17.90	2.07	2.07	160.30	160.30
25	P. N. McElfin	32.70	5.60	16.85	16.44	14.00	14.00	16.44	14.00	14.00	14.00	12.95	12.95	35.42	35.42	14.30	14.30	13.30	13.30	2.34	2.34	159.38	159.38
26	W. J. Grambs	28.40	6.48	13.85	17.40	13.75	13.75	17.40	13.75	13.75	13.75	13.65	13.65	30.48	30.48	14.85	14.85	13.10	13.10	2.13	2.13	158.82	158.82
27	H. H. Kenkel	29.60	6.74	14.75	15.90	14.00	14.00	15.90	14.00	14.00	14.00	13.00	13.00	38.22	38.22	14.75	14.75	12.95	12.95	2.26	2.26	157.65	157.65
28	N. M. Hubbard	32.40	6.50	13.40	16.50	14.25	14.25	16.50	14.25	14.25	14.25	12.80	12.80	36.12	36.12	14.30	14.30	12.85	12.85	2.43	2.43	157.49	157.49
29	S. A. W. Patterson	30.50	7.14	16.00	15.72	13.00	13.00	15.72	13.00	13.00	13.00	13.10	13.10	36.26	36.26	13.25	13.25	12.85	12.85	1.95	1.95	155.87	155.87
30	C. Martin	26.50	5.48	14.00	15.72	13.45	13.45	15.72	13.45	13.45	13.45	12.50	12.50	35.14	35.14	13.75	13.75	16.35	16.35	2.04	2.04	152.53	152.53
31	F. H. Stable	28.10	6.04	14.65	16.41	12.90	12.90	16.41	12.90	12.90	12.90	12.50	12.50	35.14	35.14	12.85	12.85	15.35	15.35	2.01	2.01	152.16	152.16
32	H. Fowler	25.60	6.72	13.00	16.20	13.35	13.35	16.20	13.35	13.35	13.35	13.05	13.05	36.12	36.12	14.60	14.60	14.05	14.05	2.44	2.44	150.25	150.25
33	W. N. King, Jr.	30.70	6.74	14.75	16.86	14.05	14.05	16.86	14.05	14.05	14.05	11.75	11.75	37.92	37.92	14.35	14.35	16.25	16.25	2.48	2.48	160.40	160.40
34	H. H. Eames	34.00	6.82	15.45	15.60	15.85	15.85	15.60	15.85	15.85	15.85	12.30	12.30	36.26	36.26	13.10	13.10	13.40	13.40	2.06	2.06	160.32	160.32
35	F. A. McNutt	27.40	5.52	14.60	17.22	16.00	16.00	17.22	16.00	16.00	16.00	13.90	13.90	40.18	40.18	11.75	11.75	14.50	14.50	2.46	2.46	158.61	158.61
36	G. E. Kent	27.30	6.44	14.50	16.62	13.00	13.00	16.62	13.00	13.00	13.00	12.05	12.05	36.12	36.12	13.85	13.85	12.55	12.55	2.04	2.04	159.39	159.39
37	J. J. Conway	24.40	6.32	13.60	13.98	12.25	12.25	13.98	12.25	12.25	12.25	10.10	10.10	33.04	33.04	13.65	13.65	15.10	15.10	2.18	2.18	141.50	141.50
38	F. N. Bell	28.40	5.86	13.25	14.46	12.55	12.55	14.46	12.55	12.55	12.55	11.35	11.35	27.44	27.44	14.55	14.55	12.00	12.00	1.72	1.72	138.16	138.16

CADET-MIDSHIPMEN.

Merit-roll of third class (47 members), annual examination, June, 1881.

Name.	Seamanship.	Trigonometry.	Analytical geometry.	Descriptive geometry.	Physica.	History and rhetoric.	French.	Drawing.	Conduct.	Aggregate.
Maxima.....	12	32	28	12	16	24	20	8		152
N. D. Greene.....	11.04	30.80	27.93	11.70	13.88	21.60	17.70	6.88	0.55	140.96
G. W. Street.....	10.56	31.68	28.49	12.15	14.40	20.58	17.70	6.06	0.89	140.73
W. E. Bowman.....	10.80	28.80	26.88	11.25	11.92	21.30	16.30	6.90	1.02	133.13
C. E. Sweeting.....	9.57	30.16	26.11	11.52	12.84	20.10	16.70	6.62	1.84	131.78
J. B. Jackson.....	9.69	29.44	25.48	10.86	13.24	19.74	16.95	6.64	0.45	131.59
R. W. Barkley.....	9.99	27.52	23.10	11.37	11.76	21.18	15.80	7.38	0.52	127.66
B. E. Thurston.....	9.87	26.48	24.36	11.07	12.68	18.42	16.60	7.10	0.73	125.85
M. E. Lennon.....	8.34	27.84	24.22	10.20	13.00	21.00	13.20	6.30	1.06	122.04
H. George.....	10.53	24.72	24.50	10.44	13.04	20.10	13.00	6.60	1.19	122.34
G. M. von Schrader.....	9.72	28.24	21.98	8.91	11.64	18.90	13.45	6.88	1.18	118.54
A. S. Keith.....	8.73	22.88	22.62	10.08	12.12	16.36	15.60	7.26	0.87	116.98
R. T. Frazier.....	8.25	24.24	22.33	9.57	11.40	19.62	16.05	6.22	0.72	116.96
F. L. Chaplin.....	10.26	23.12	20.79	9.63	11.60	20.16	15.50	6.06	0.80	116.32
R. C. Alexander.....	9.45	22.88	21.14	9.75	12.28	18.36	14.45	6.78	0.45	114.64
C. T. Brady.....	9.09	23.12	20.79	8.73	10.26	16.68	16.10	7.10	1.28	113.60
W. A. Megrath.....	9.51	25.36	21.77	9.27	11.56	15.96	13.70	6.74	1.21	112.66
A. P. Agee.....	8.49	23.92	21.84	9.27	10.72	18.66	14.50	5.18	1.29	111.29
G. C. Stout.....	10.05	21.36	20.23	9.21	12.36	18.06	14.25	6.50	1.48	111.14
J. H. Barnard.....	10.11	23.52	18.55	8.76	12.28	17.68	13.90	7.34	1.30	110.74
T. H. Gignilliat.....	8.40	23.12	21.98	9.09	11.28	17.04	13.30	7.18	1.36	110.63
J. A. Jackson.....	9.15	23.44	20.44	8.34	11.64	17.82	15.35	6.00	1.62	110.56
R. L. Lerch.....	8.73	20.56	19.46	8.16	12.12	18.54	17.00	6.80	1.22	110.15
R. H. Woods.....	9.06	21.84	18.90	8.79	10.64	16.68	16.30	5.84	0.56	107.79
T. A. Witherspoon.....	9.57	22.08	18.41	8.58	12.12	17.76	14.15	5.98	0.93	107.72
H. H. Balthis.....	8.88	22.08	18.34	8.10	12.24	18.48	14.00	6.24	0.80	107.66
P. H. Philbin.....	9.03	21.12	21.03	8.16	10.60	17.16	15.10	5.72	0.98	107.54
E. W. Dalrymple.....	8.25	23.52	19.81	7.83	10.30	18.00	14.60	5.96	1.67	106.66
T. V. Toney.....	10.89	21.36	17.85	8.61	10.36	17.58	14.30	5.92	0.94	105.93
F. R. Colvin.....	8.28	21.84	19.04	8.46	11.32	18.24	14.35	5.10	1.07	105.56
T. S. O'Leary.....	9.06	20.64	18.63	7.80	11.20	17.10	14.80	6.80	0.75	105.48
S. Z. Mitchell.....	9.21	21.44	19.32	7.56	10.08	16.08	14.80	5.24	1.46	102.27
E. B. Weeks.....	7.80	21.44	19.11	8.22	10.44	16.68	14.05	5.60	1.53	101.81
W. H. Ledbetter.....	8.10	21.68	18.27	7.29	10.32	15.42	12.95	5.56	1.12	98.47
W. J. Wilson.....	7.71	20.08	18.63	7.56	10.12	16.38	12.80	5.54	0.81	98.21
W. T. Gray.....	8.25	18.88	18.69	7.56	10.08	16.08	12.90	5.58	0.83	97.19
H. C. Pettit.....	7.32	23.12	18.97	7.23	10.36	18.18	13.60	6.56	0.83	104.71
T. W. Hayden.....	7.59	22.00	19.11	7.80	8.20	17.46	14.05	5.60	1.85	99.96
A. B. Legaré.....	8.61	22.68	18.20	7.59	8.64	15.18	13.25	6.06	1.24	98.47
A. Dovalé.....	8.58	18.50	18.90	7.80	9.80	15.36	13.85	6.52	1.16	98.21
J. F. Carpenter.....	8.10	20.00	18.41	7.95	10.32	15.48	12.15	6.20	1.31	97.80
T. B. Smith.....	8.40	20.56	17.99	6.84	9.88	17.10	12.80	5.18	1.73	97.02
C. T. Phythian.....	8.40	19.68	18.27	7.95	9.72	15.12	12.50	5.96	0.94	96.66
W. W. Ricketts.....	6.99	22.48	17.99	6.51	8.52	14.52	12.50	5.60	0.68	94.43
C. R. Reynolds.....	5.79	22.72	14.63	6.60	6.40	14.52	14.75	5.74	0.99	90.16
E. G. Temple.....	6.78	17.28	16.17	5.82	8.52	16.86	13.20	6.16	0.78	90.01
J. J. G. Cooper.....	a	23.84	a	a	a	a	a	5.16	0.93	.....
C. T. Hepp.....	a	a	a	a	a	a	a	6.68	0.99	.....

CADET-MIDSHIP

Merit-roll of fourth class (50 members), a

Order of annual merit.	Name.	Summative
	Maxima	
*1	F. E. Curtis	6.
*2	N. S. Moseley	7.
3	C. P. Plunkett	6.
4	Herbert McNulta	6.
5	J. S. McKean	6.
6	A. M. Beecher	7.
7	C. S. Williams	6.
8	Roger Welles, jr	6.
9	H. P. Jones, jr	6.
10	W. R. Shoemaker	7.
11	T. H. Leary	6.
12	W. B. Hoggatt	7.
13	W. E. Cook	5.
14	L. K. Seymour	6.
15	Wirt McCreary	6.
16	D. F. Terrell	6.
17	C. H. Hayes	6.
18	A. E. McIntire	6.
19	S. F. Smith	6.
20	J. D. McDonald	6.
21	William Johnston	6.
22	Harry Friedlander	5.
23	L. H. Jastremski	6.
24	J. R. Harrell	6.
25	C. W. Hazeltine	6.
26	W. A. O'Malley	6.
27	Victor Macpherson	6.
28	J. W. Maxey	6.
29	Vaulx Carter	6.
30	W. E. Wirt	6.
31	J. A. McCook	6.
32	R. R. W. Stevens	5.
33	W. A. Barker	5.
34	W. P. Williams	5.
35	H. H. McCord	6.
36	F. H. Sparling	6.
37	W. W. Bush, jr	5.
38	A. L. Lovenskiold	4.
39	A. B. Sloan	5.
40	J. L. Davis	6.
41	W. W. Gilmer	6.
42	E. R. Cassidy	5.
43	F. G. Raichle	6.
44	F. H. Sargent	6.
45	J. C. Atwood	6.
46	J. G. Lamison	5.

CADET-MIDSHIPMEN—Continued.

Merit-roll of fourth class (50 members), annual examination, June, 1891.

Name.	Seamanship.	Mathematics.	History and Eng- lish.	French.	Drawing.	Conduct.	Aggregate.
Maxima	8	32	20	8	8		76
J. W. Wood	4.80	14.24	13.95	5.80	4.94	0.52	43.21
H. D. Blake	5.50	20.40	12.60	5.14	6.28	0.53	42.75
Charles Venable	4.36	17.36	11.55	5.02	5.18	0.77	42.70
W. G. Ganong	5.90	10.72	6.05	4.18	6.54	1.06	32.33

4 N A R

CADET-ENGINEERS.

Merit-roll of first class (25 members), annual examination, June, 1881, and general merit-roll for four years.

Order of general merit.	Name.	Ship-building.	Mechanical drawing and fabrication.	Designing machinery and engine.	Boilers.	Electricity.	Physical measurements.	Applied mechanics.	Naval architecture and method of fastenings.	Naval architecture (elective).	French and Spanish.	Conduct.	Aggregate for fourth year.	Aggregate for third year.	Aggregate for second year.	Aggregate for first year.	General aggregate for four years.
		16	56	88	12	24	28	44	24		12		304	228	152	76	760
1	J. M. Whitham	13.80	50.68	80.30	11.25	20.82	25.20	42.24	23.22	3.36	8.82	1.62	278.07	188.17	119.21	57.16	642.61
2	Gustave Kaemmerling	11.20	47.88	69.96	10.50	19.98	26.20	37.40	20.58	2.64	9.78	2.70	252.42	178.40	121.66	62.07	614.55
3	Oliver B. Shallenberger	12.04	51.66	66.44	10.65	20.40	26.09	30.91	16.62	.....	9.33	3.84	240.81	177.96	115.40	57.78	591.95
4	James E. Byrne	11.56	48.58	67.32	9.57	20.64	23.80	35.64	18.56	2.28	9.54	8.96	244.53	169.45	111.52	59.30	584.80
5	Frank B. Dowst	11.92	46.20	70.18	10.35	18.54	22.40	33.22	18.00	1.92	9.63	3.93	238.43	167.91	112.04	54.80	573.18
6	Kenneth McAlpine	11.56	44.94	65.78	8.61	19.14	24.50	35.09	19.62	2.16	10.50	5.19	236.71	168.40	109.70	54.42	569.23
7	William S. Smith	11.28	47.60	65.64	10.59	22.38	25.90	32.56	18.08	2.04	8.46	2.64	245.89	162.10	104.43	53.52	565.04
8	William T. Webster	12.40	50.82	68.42	10.35	17.70	23.10	29.59	18.12	.....	9.00	3.12	236.38	160.83	108.96	53.12	565.30
9	Lloyd Bankson	12.46	44.38	65.12	9.84	18.30	23.60	31.35	15.90	.....	8.91	2.43	228.13	165.21	113.29	53.33	559.96
10	Clarence H. Mathews	12.04	41.24	68.64	8.85	19.92	21.90	36.85	19.20	2.16	9.54	2.67	232.77	160.91	101.11	50.22	552.01
11	De Witt C. Redgrave	10.20	44.94	62.70	8.94	17.04	23.90	31.03	17.04	.96	8.97	3.12	222.49	168.21	107.63	53.62	551.95
12	Robert Stewart, Jr.	10.96	42.70	62.20	8.43	18.00	23.80	30.58	18.72	.96	9.51	2.04	223.68	159.06	108.71	53.96	551.20
13	Isaac B. Parsons	11.40	50.12	63.14	9.72	15.30	24.50	29.59	15.84	.....	8.40	4.74	223.27	150.67	111.42	54.65	549.01
14	William W. White	11.20	44.24	67.54	8.70	18.54	19.60	35.09	17.46	1.56	8.40	3.84	218.49	162.26	106.41	49.75	546.91
15	Blas C. Sampson	10.72	43.00	62.92	8.28	16.80	19.00	36.52	18.76	2.28	8.49	4.63	224.06	155.48	110.31	53.51	545.96
16	Lyman B. Perkins	11.36	48.44	68.61	9.90	16.98	21.00	29.04	16.62	.....	9.27	4.41	226.80	157.97	108.48	52.54	545.89
17	Charles E. Belden	10.80	41.16	61.46	8.61	19.50	23.80	33.41	15.10	.60	9.30	1.41	226.24	160.74	98.02	50.53	544.57
18	Mathew Arnold	11.48	40.74	61.52	8.70	17.70	21.70	34.31	16.14	.60	9.90	3.06	219.99	163.90	106.42	50.26	539.04
19	Maxima	12.40	47.60	61.44	8.52	17.61	24.80	28.08	18.20	.....	8.28	4.80	231.39	150.28	106.90	48.11	536.11

.....	71 W	74 1/4 W	77 1/4 W	80 3/4 W	84 W	87 1/4 W	90 3/4 W	94 W	97 1/4 W	100 3/4 W	104 W	107 1/4 W	110 3/4 W	114 W	117 1/4 W	120 3/4 W	124 W	127 1/4 W	130 3/4 W	134 W	137 1/4 W	140 3/4 W	144 W	147 1/4 W	150 3/4 W	154 W	157 1/4 W	160 3/4 W	164 W	167 1/4 W	170 3/4 W	174 W	177 1/4 W	180 3/4 W	184 W	187 1/4 W	190 3/4 W	194 W	197 1/4 W	200 3/4 W	204 W	207 1/4 W	210 3/4 W	214 W	217 1/4 W	220 3/4 W	224 W	227 1/4 W	230 3/4 W	234 W	237 1/4 W	240 3/4 W	244 W	247 1/4 W	250 3/4 W	254 W	257 1/4 W	260 3/4 W	264 W	267 1/4 W	270 3/4 W	274 W	277 1/4 W	280 3/4 W	284 W	287 1/4 W	290 3/4 W	294 W	297 1/4 W	300 3/4 W	304 W	307 1/4 W	310 3/4 W	314 W	317 1/4 W	320 3/4 W	324 W	327 1/4 W	330 3/4 W	334 W	337 1/4 W	340 3/4 W	344 W	347 1/4 W	350 3/4 W	354 W	357 1/4 W	360 3/4 W	364 W	367 1/4 W	370 3/4 W	374 W	377 1/4 W	380 3/4 W	384 W	387 1/4 W	390 3/4 W	394 W	397 1/4 W	400 3/4 W	404 W	407 1/4 W	410 3/4 W	414 W	417 1/4 W	420 3/4 W	424 W	427 1/4 W	430 3/4 W	434 W	437 1/4 W	440 3/4 W	444 W	447 1/4 W	450 3/4 W	454 W	457 1/4 W	460 3/4 W	464 W	467 1/4 W	470 3/4 W	474 W	477 1/4 W	480 3/4 W	484 W	487 1/4 W	490 3/4 W	494 W	497 1/4 W	500 3/4 W	504 W	507 1/4 W	510 3/4 W	514 W	517 1/4 W	520 3/4 W	524 W	527 1/4 W	530 3/4 W	534 W	537 1/4 W	540 3/4 W	544 W	547 1/4 W	550 3/4 W	554 W	557 1/4 W	560 3/4 W	564 W	567 1/4 W	570 3/4 W	574 W	577 1/4 W	580 3/4 W	584 W	587 1/4 W	590 3/4 W	594 W	597 1/4 W	600 3/4 W	604 W	607 1/4 W	610 3/4 W	614 W	617 1/4 W	620 3/4 W	624 W	627 1/4 W	630 3/4 W	634 W	637 1/4 W	640 3/4 W	644 W	647 1/4 W	650 3/4 W	654 W	657 1/4 W	660 3/4 W	664 W	667 1/4 W	670 3/4 W	674 W	677 1/4 W	680 3/4 W	684 W	687 1/4 W	690 3/4 W	694 W	697 1/4 W	700 3/4 W	704 W	707 1/4 W	710 3/4 W	714 W	717 1/4 W	720 3/4 W	724 W	727 1/4 W	730 3/4 W	734 W	737 1/4 W	740 3/4 W	744 W	747 1/4 W	750 3/4 W	754 W	757 1/4 W	760 3/4 W	764 W	767 1/4 W	770 3/4 W	774 W	777 1/4 W	780 3/4 W	784 W	787 1/4 W	790 3/4 W	794 W	797 1/4 W	800 3/4 W	804 W	807 1/4 W	810 3/4 W	814 W	817 1/4 W	820 3/4 W	824 W	827 1/4 W	830 3/4 W	834 W	837 1/4 W	840 3/4 W	844 W	847 1/4 W	850 3/4 W	854 W	857 1/4 W	860 3/4 W	864 W	867 1/4 W	870 3/4 W	874 W	877 1/4 W	880 3/4 W	884 W	887 1/4 W	890 3/4 W	894 W	897 1/4 W	900 3/4 W	904 W	907 1/4 W	910 3/4 W	914 W	917 1/4 W	920 3/4 W	924 W	927 1/4 W	930 3/4 W	934 W	937 1/4 W	940 3/4 W	944 W	947 1/4 W	950 3/4 W	954 W	957 1/4 W	960 3/4 W	964 W	967 1/4 W	970 3/4 W	974 W	977 1/4 W	980 3/4 W	984 W	987 1/4 W	990 3/4 W	994 W	997 1/4 W	1000 3/4 W	1004 W	1007 1/4 W	1010 3/4 W	1014 W	1017 1/4 W	1020 3/4 W	1024 W	1027 1/4 W	1030 3/4 W	1034 W	1037 1/4 W	1040 3/4 W	1044 W	1047 1/4 W	1050 3/4 W	1054 W	1057 1/4 W	1060 3/4 W	1064 W	1067 1/4 W	1070 3/4 W	1074 W	1077 1/4 W	1080 3/4 W	1084 W	1087 1/4 W	1090 3/4 W	1094 W	1097 1/4 W	1100 3/4 W	1104 W	1107 1/4 W	1110 3/4 W	1114 W	1117 1/4 W	1120 3/4 W	1124 W	1127 1/4 W	1130 3/4 W	1134 W	1137 1/4 W	1140 3/4 W	1144 W	1147 1/4 W	1150 3/4 W	1154 W	1157 1/4 W	1160 3/4 W	1164 W	1167 1/4 W	1170 3/4 W	1174 W	1177 1/4 W	1180 3/4 W	1184 W	1187 1/4 W	1190 3/4 W	1194 W	1197 1/4 W	1200 3/4 W	1204 W	1207 1/4 W	1210 3/4 W	1214 W	1217 1/4 W	1220 3/4 W	1224 W	1227 1/4 W	1230 3/4 W	1234 W	1237 1/4 W	1240 3/4 W	1244 W	1247 1/4 W	1250 3/4 W	1254 W	1257 1/4 W	1260 3/4 W	1264 W	1267 1/4 W	1270 3/4 W	1274 W	1277 1/4 W	1280 3/4 W	1284 W	1287 1/4 W	1290 3/4 W	1294 W	1297 1/4 W	1300 3/4 W	1304 W	1307 1/4 W	1310 3/4 W	1314 W	1317 1/4 W	1320 3/4 W	1324 W	1327 1/4 W	1330 3/4 W	1334 W	1337 1/4 W	1340 3/4 W	1344 W	1347 1/4 W	1350 3/4 W	1354 W	1357 1/4 W	1360 3/4 W	1364 W	1367 1/4 W	1370 3/4 W	1374 W	1377 1/4 W	1380 3/4 W	1384 W	1387 1/4 W	1390 3/4 W	1394 W	1397 1/4 W	1400 3/4 W	1404 W	1407 1/4 W	1410 3/4 W	1414 W	1417 1/4 W	1420 3/4 W	1424 W	1427 1/4 W	1430 3/4 W	1434 W	1437 1/4 W	1440 3/4 W	1444 W	1447 1/4 W	1450 3/4 W	1454 W	1457 1/4 W	1460 3/4 W	1464 W	1467 1/4 W	1470 3/4 W	1474 W	1477 1/4 W	1480 3/4 W	1484 W	1487 1/4 W	1490 3/4 W	1494 W	1497 1/4 W	1500 3/4 W	1504 W	1507 1/4 W	1510 3/4 W	1514 W	1517 1/4 W	1520 3/4 W	1524 W	1527 1/4 W	1530 3/4 W	1534 W	1537 1/4 W	1540 3/4 W	1544 W	1547 1/4 W	1550 3/4 W	1554 W	1557 1/4 W	1560 3/4 W	1564 W	1567 1/4 W	1570 3/4 W	1574 W	1577 1/4 W	1580 3/4 W	1584 W	1587 1/4 W	1590 3/4 W	1594 W	1597 1/4 W	1600 3/4 W	1604 W	1607 1/4 W	1610 3/4 W	1614 W	1617 1/4 W	1620 3/4 W	1624 W	1627 1/4 W	1630 3/4 W	1634 W	1637 1/4 W	1640 3/4 W	1644 W	1647 1/4 W	1650 3/4 W	1654 W	1657 1/4 W	1660 3/4 W	1664 W	1667 1/4 W	1670 3/4 W	1674 W	1677 1/4 W	1680 3/4 W	1684 W	1687 1/4 W	1690 3/4 W	1694 W	1697 1/4 W	1700 3/4 W	1704 W	1707 1/4 W	1710 3/4 W	1714 W	1717 1/4 W	1720 3/4 W	1724 W	1727 1/4 W	1730 3/4 W	1734 W	1737 1/4 W	1740 3/4 W	1744 W	1747 1/4 W	1750 3/4 W	1754 W	1757 1/4 W	1760 3/4 W	1764 W	1767 1/4 W	1770 3/4 W	1774 W	1777 1/4 W	1780 3/4 W	1784 W	1787 1/4 W	1790 3/4 W	1794 W	1797 1/4 W	1800 3/4 W	1804 W	1807 1/4 W	1810 3/4 W	1814 W	1817 1/4 W	1820 3/4 W	1824 W	1827 1/4 W	1830 3/4 W	1834 W	1837 1/4 W	1840 3/4 W	1844 W	1847 1/4 W	1850 3/4 W	1854 W	1857 1/4 W	1860 3/4 W	1864 W	1867 1/4 W	1870 3/4 W	1874 W	1877 1/4 W	1880 3/4 W	1884 W	1887 1/4 W	1890 3/4 W	1894 W	1897 1/4 W	1900 3/4 W	1904 W	1907 1/4 W	1910 3/4 W	1914 W	1917 1/4 W	1920 3/4 W	1924 W	1927 1/4 W	1930 3/4 W	1934 W	1937 1/4 W	1940 3/4 W	1944 W	1947 1/4 W	1950 3/4 W	1954 W	1957 1/4 W	1960 3/4 W	1964 W	1967 1/4 W	1970 3/4 W	1974 W	1977 1/4 W	1980 3/4 W	1984 W	1987 1/4 W	1990 3/4 W	1994 W	1997 1/4 W	2000 3/4 W	2004 W	2007 1/4 W	2010 3/4 W	2014 W	2017 1/4 W	2020 3/4 W	2024 W	2027 1/4 W	2030 3/4 W	2034 W	2037 1/4 W	2040 3/4 W	2044 W	2047 1/4 W	2050 3/4 W	2054 W	2057 1/4 W	2060 3/4 W	2064 W	2067 1/4 W	2070 3/4 W	2074 W	2077 1/4 W	2080 3/4 W	2084 W	2087 1/4 W	2090 3/4 W	2094 W	2097 1/4 W	2100 3/4 W	2104 W	2107 1/4 W	2110 3/4 W	2114 W	2117 1/4 W	2120 3/4 W	2124 W	2127 1/4 W	2130 3/4 W	2134 W	2137 1/4 W	2140 3/4 W	2144 W	2147 1/4 W	2150 3/4 W	2154 W	2157 1/4 W	2160 3/4 W	2164 W	2167 1/4 W	2170 3/4 W	2174 W	2177 1/4 W	2180 3/4 W	2184 W	2187 1/4 W	2190 3/4 W	2194 W	2197 1/4 W	2200 3/4 W	2204 W	2207 1/4 W	2210 3/4 W	2214 W	2217 1/4 W	2220 3/4 W	2224 W	2227 1/4 W	2230 3/4 W	2234 W	2237 1/4 W	2240 3/4 W	2244 W	2247 1/4 W	2250 3/4 W	2254 W	2257 1/4 W	2260 3/4 W	2264 W	2267 1/4 W	2270 3/4 W	2274 W	2277 1/4 W	2280 3/4 W	2284 W	2287 1/4 W	2290 3/4 W	2294 W	2297 1/4 W	2300 3/4 W	2304 W	2307 1/4 W	2310 3/4 W	2314 W	2317 1/4 W	2320 3/4 W	2324 W	2327 1/4 W	2330 3/4 W	2334 W	2337 1/4 W	2340 3/4 W	2344 W	2347 1/4 W	2350 3/4 W	2354 W	2357 1/4 W	2360 3/4 W	2364 W	2367 1/4 W	2370 3/4 W	2374 W	2377 1/4 W	2380 3/4 W	2384 W	2387 1/4 W	2390 3/4 W	2394 W	2397 1/4 W	2400 3/4 W	2404 W	2407 1/4 W	2410 3/4 W	2414 W	2417 1/4 W	2420 3/4 W	2424 W	2427 1/4 W	2430 3/4 W	2434 W	2437 1/4 W	2440 3/4 W	2444 W	2447 1/4 W	2450 3/4 W	2454 W	2457 1/4 W	2460 3/4 W	2464 W	2467 1/4 W	2470 3/4 W	2474 W	2477 1/4 W	2480 3/4 W	2484 W	2487 1/4 W	2490 3/4 W	2494 W	2497 1/4 W	2500 3/4 W	2504 W	2507 1/4 W	2510 3/4 W	2514 W	2517 1/4 W	2520 3/4 W	2524 W	2527 1/4 W	2530 3/4 W	2534 W	2537 1/4 W	2540 3/4 W	2544 W	2547 1/4 W	2550 3/4 W	2554 W	2557 1/4 W	2560 3/4 W	2564 W	2567 1/4 W	2570 3/4 W	2574 W	2577 1/4 W	2580 3/4 W	2584 W	2587 1/4 W	2590 3/4 W	2594 W	2597 1/4 W	2600 3/4 W	2604 W	2607 1/4 W	2610 3/4 W	2614 W	2617 1/4 W	2620 3/4 W	2624 W	2627 1/4 W	2630 3/4 W	2634 W	2637 1/4 W	2640 3/4 W	2644 W	2647 1/4 W	2650 3/4 W	2654 W	2657 1/4 W	2660 3/4 W	2664 W	2667 1/4 W	2670 3/4 W	2674 W	2677 1/4 W	2680 3/4 W	2684 W	2687 1/4 W	2690 3/4 W	2694 W	2697 1/4 W	2700 3/4 W	2704 W	2707 1/4 W	2710 3/4 W	2714 W	2717 1/4 W	2720 3/4 W	2724 W	2727 1/4 W	2730 3/4 W	2734 W	2737 1/4 W	2740 3/4 W	2744 W	2747 1/4 W	2750 3/4 W	2754 W	2757 1/4 W	2760 3/4 W	2764 W	2767 1/4 W	2770 3/4 W	2774 W	2777 1/4 W	2780 3/4 W	2784 W	2787 1/4 W	2790 3/4 W	2794 W	2797 1/4 W	2800 3/4 W	2804 W	2807 1/4 W	2810 3/4 W	2814 W	2817 1/4 W	2820 3/4 W	2824 W	2827 1/4 W	2830 3/4 W	2834 W	2837 1/4 W	2840 3/4 W	2844 W	2847 1/4 W	2850 3/4 W	2854 W	2857 1/4 W	2860 3/4 W	2864 W	2867 1/4 W	2870 3/4 W	2874 W	2877 1/4 W	2880 3/4 W	2884 W	2887 1/4 W	2890 3/4 W	2894 W	2897 1/4 W	2900 3/4 W	2904 W	2907 1/4 W	2910 3/4 W	2914 W	2917 1/4 W	2920 3/4 W	2924 W	2927 1/4 W	2930 3/4 W	2934 W	2937 1/4 W	2940 3/4 W	2944 W	2947 1/4 W	2950 3/4 W	2954 W	2957 1/4 W	2960 3/4 W	2964 W	2967 1/4 W	2970 3/4 W	2974 W	2977 1/4 W	2980 3/4 W	2984 W	2987 1/4 W	2990 3/4 W	2994 W	2997 1/4 W	3000 3/4 W	3004 W	3007 1/4 W	3010 3/4 W	3014 W	3017 1/4 W	3020 3/4 W	3024 W	3027 1/4 W	3030 3/4 W	3034 W	3037 1/4 W	3040 3/4 W	3044 W	3047 1/4 W	3050 3/4 W	3054 W	3057 1/4 W	3060 3/4 W	3064 W	3067 1/4 W	3070 3/4 W	3074 W	3077 1/4 W	3080 3/4 W	3084 W	3087 1/4 W	3090 3/4 W	3094 W	3097 1/4 W	3100 3/4 W	3104 W	3107 1/4 W	3110 3/4 W	3114 W	3117 1/4 W	3120 3/4 W	3124 W	3127 1/4 W	3130 3/4 W	3134 W	3137 1/4 W	3140 3/4 W	3144 W	3147 1/4 W	3150 3/4 W	3154 W	3157 1/4 W	3160 3/4 W	3164 W	3167 1/4 W	3170 3/4 W	3174 W	3177 1/4 W	3180 3/4 W	3184 W	3187 1/4 W	3190 3/4 W	3194 W	3197 1/4 W	3200 3/4 W	3204 W	3207 1/4 W	3210 3/4 W	3214 W	3217 1/4 W	3220 3/4 W	3224 W	3227 1/4 W	3230 3/4 W	3234 W	3237 1/4 W	3240 3/4 W	3244 W	3247 1/4 W	3250 3/4 W	3254 W	3257 1/4 W	3260 3/4 W	3264 W	3267 1/4 W	3270 3/4 W	3274 W	3277 1/4 W	3280 3/4 W	3284 W	3287 1/4 W	3290 3/4 W	3294 W	3297 1/4 W	3300 3/4 W	3304 W	3307 1/4 W	3310 3/4 W	3314 W	3317 1/4 W	3320 3/4 W	3324 W	3327 1/4 W	3330 3/4 W	3334 W	3337 1/4 W	3340 3/4 W	3344 W	3347 1/4 W	3350 3/4 W	3354 W	3357 1/4 W	3360 3/4 W	3364 W	3367 1/4 W	3370 3/4 W	3374 W	3377 1/4 W	3380 3/4 W	3384 W	3387 1/4 W	3390 3/4 W	3394 W	3397 1/4 W	3400 3
-------	------	----------	----------	----------	------	----------	----------	------	----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	-----------	-------	-----------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	------------	--------	------------	--------

CADET-ENGINEERS.

Merit-roll of second class (25 members), annual examination, June, 1921

Order of annual merit.	Name.	Mechanical drawing.	Fabrication of machinery.	Designing machinery.	Astronomy.	Physics and chemistry.	Heat and light.	Mechanics and calculus.	English and history.	French.	Conduct.
	Maxima	20	24	32	16	20	20	56	20	20	
*1	Emil Theiss	17.40	21.60	29.12	14.84	19.50	18.55	55.86	16.75	21.45	2.10
*2	Robert W. Gatewood.....	17.95	19.08	31.20	13.48	18.50	18.00	58.66	16.70	20.65	2.25
*3	William H. P. Creighton	17.45	20.40	28.88	13.64	18.40	17.65	50.26	16.95	18.55	2.00
*4	George Robert Ferguson	19.10	21.06	28.40	13.84	17.50	16.60	51.24	14.90	16.75	1.50
*5	Peter Miller.....	17.05	19.63	28.88	14.20	18.35	17.50	51.94	15.80	16.50	1.90
6	James Henry Fitts	17.35	19.02	25.92	14.04	17.90	16.63	48.30	15.50	20.10	1.80
7	William Henry Chambers	17.90	19.86	28.48	13.36	16.80	17.45	45.22	16.75	16.55	1.65
8	Charles Edward Rommell.....	17.10	18.78	24.96	13.24	16.00	16.45	42.14	15.45	16.40	1.15
9	Otto Charles Gaantner.....	16.65	21.66	24.96	11.56	17.10	15.00	40.60	14.85	16.00	1.40
10	Arthur Henry Clarke.....	15.25	16.98	22.80	13.52	14.85	15.55	42.00	15.55	16.95	1.25
11	Frank Henry Conant	15.85	20.46	24.08	12.08	16.15	14.65	35.98	14.95	15.65	2.10
12	Joseph Henry Pendleton.....	13.85	19.26	24.80	11.48	16.35	14.15	38.48	14.80	15.75	2.20
13	John Calvin Leonard.....	15.00	18.54	22.64	14.04	14.85	14.75	38.36	15.00	15.90	1.90
14	Clarence Calhoun Willis.....	15.10	19.74	21.44	12.56	14.30	14.60	39.48	15.20	16.35	2.50
15	Robert Bernard Higgins.....	17.10	20.10	20.96	11.52	17.00	15.00	38.22	12.50	15.55	1.60
16	Harry Leroy Hawthorne.....	17.25	19.02	21.92	12.28	15.85	13.60	34.78	14.00	14.75	1.80
17	Willis Bunner Day	15.95	19.52	24.24	11.20	14.60	13.10	36.68	15.45	15.65	1.10
18	Andrew McAllister.....	15.95	19.02	21.76	10.96	15.10	12.95	38.92	15.50	14.70	1.60
19	Walter Roberts Addicks.....	16.20	19.20	23.76	11.84	13.70	14.25	35.56	15.50	13.70	2.10
20	Charles Henry Howland	15.55	17.58	22.40	11.12	13.30	13.30	37.10	15.40	15.30	2.20
21	Ward Philo Winchell.....	16.50	19.66	22.64	11.00	13.95	13.05	35.00	12.50	15.50	2.50
22	Frederick Edward Coloy.....	15.40	17.64	22.56	11.36	13.05	13.30	35.42	14.20	14.25	2.50
†	Harry Girard Leopold.....	15.35	19.92	25.68	10.64	15.10	13.60	41.30	12.95	13.30	2.60
†	Daniel D. Gladstone	16.10	18.18	20.16	10.36	13.95	13.40	33.00	13.40	14.25	2.50
;	Thomas A. W. Shock.....	14.85	17.70	18.64	9.76	12.05	12.25	35.00	13.65	14.15	2.00

CADET-ENGINEERS.

Merit-roll of third class (25 members), annual examination, June, 1881.

Name.	Mathematics.	Mechanical drawing and fabrication of machinery.	Physics.	History and rhetoric.	French.	Conduct.	Aggregate.
xima	72	20	16	24	20		152
Wilson Armistead	73.26	17.90	13.80	20.64	16.45	.43	141.62
Joseph Baxter	70.38	17.15	14.48	21.78	17.20	.46	140.53
Phillips Eaton	69.66	16.60	13.56	18.96	18.00	.66	136.12
Edward Woodruff	67.32	17.70	14.96	20.28	16.70	1.03	135.93
Sleeper Aldrich	66.06	18.25	14.48	18.18	15.45	.36	132.06
Errie Ellicott	63.90	17.85	12.52	20.52	16.95	.50	131.24
Washington Littlehales	60.66	10.40	14.16	21.60	17.15	.28	129.69
Wilson Dyson	63.90	15.60	13.36	19.08	16.35	1.04	127.25
Frederick Zinnel	62.10	16.15	12.72	19.74	16.20	.76	126.15
Francis Darrah	59.04	16.70	13.84	19.96	17.40	1.07	125.89
Er Seaman Halstead	58.32	15.45	18.24	18.18	15.85	1.01	120.03
Edwin Barnes	53.64	16.05	12.24	19.44	16.30	1.18	117.00
Abby Field	56.34	16.60	11.40	17.22	15.00	.15	116.41
Jacob Gross	54.18	17.25	11.00	17.16	16.35	.62	115.32
Mary Quinby	50.22	16.20	12.08	16.88	17.70	1.74	110.84
Alexander Gillis	48.60	16.50	10.24	18.12	14.95	1.31	107.10
Cromwell Herbert	51.12	14.15	11.44	16.74	15.20	1.60	107.05
Franklin Webster	49.68	14.20	11.96	16.74	15.85	1.62	106.81
Beggs Caruwell	49.68	15.65	10.72	17.58	14.10	1.11	106.62
Edward Palmer	48.60	16.90	11.68	15.60	13.00	.47	106.11
Henger	48.06	14.55	12.04	16.74	14.50	1.36	104.53
Hunter Lawrence	45.72	16.45	11.44	16.08	13.35	.92	102.12
Joseph Ryan	45.18	14.10	11.36	15.96	14.75	1.57	99.78
Straughn Glascock	45.00	13.20	10.92	16.14	14.40	1.74	97.92
Duvall, Jr.	45.54	15.15	9.44	15.78	13.35	1.74	97.52

CADET-ENGINEERS.

Merit-roll of fourth class (26 members), annual examination, June, 1881.

Order of annual merit.	Name.	Mathematics.	Mechanical drawing and fabrication of machinery.	English and history.	French.	Conduct.
	Maxima.....	36	12	20	8	
*1	Washington L. Capps	34.20	9.48	17.65	8.28	0.05
*2	Chester M. Knepper.....	33.03	8.61	18.10	5.96	0.32
*3	Andrew P. Biddle.....	31.41	8.34	17.55	8.32	0.44
4	Walter O. Hulme.....	30.87	10.74	16.70	6.38	0.23
5	Henry E. Parmenter.....	31.86	11.01	15.15	5.28	0.21
6	Charles H. Hewes.....	32.22	10.14	15.30	5.48	0.22
7	Charles C. Baron.....	30.33	9.57	16.20	6.88	0.35
8	Arthur L. Hughes.....	28.98	7.98	18.85	7.08	0.34
9	Milton Dargan.....	29.52	8.94	16.75	6.96	0.70
10	Lawrence A. Wedderburn.....	27.09	9.72	16.45	8.24	0.16
11	Frederic J. Loomis.....	29.07	10.89	15.50	5.86	0.13
12	Frank K. Hill.....	29.25	9.90	16.60	5.52	0.37
13	Charles M. Fahs.....	28.80	8.34	16.70	6.82	0.61
14	Richard O. Crisp.....	31.86	9.12	14.40	5.34	0.09
15	Humes H. Whittlesey.....	27.27	8.67	17.35	5.80	0.14
16	Horace A. Field.....	27.45	9.33	16.35	5.80	0.34
17	Robert L. Wernitz.....	25.56	8.76	17.50	6.90	0.20
18	Edward Davis.....	26.01	10.71	16.35	5.90	0.51
19	Henry K. McCay.....	27.36	8.79	15.30	6.80	0.34
20	Horace W. Jones.....	26.82	9.12	15.40	6.00	0.24
21	Pierre O. Keilholtz.....	25.65	10.80	13.50	5.50	0.26
22	Albert C. Mathews.....	24.21	10.41	15.10	5.40	0.48
23	John B. Starr.....	24.12	8.79	15.65	5.78	0.29
24	Thomas P. Pattison.....	24.66	9.69	13.90	5.68	0.37
25	Thornton R. Richardson.....	23.40	8.16	14.30	5.20	0.38
26	Robert H. Orr.....	22.68	7.92	13.65	5.20	0.45

REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

NOMINATION.

The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; ten appointed at large. According to the act of Congress approved June 17, 1878, there shall not be at any time more in said Academy appointed at large than ten." It will take some time before the number at large now at the Academy can be reduced to ten, there will be no such appointments at present.

I. The nomination of candidates for admission from the District of Columbia and at large is made by the President. The nomination of a candidate from any Congressional district or Territory is made on the recommendation of the Member or Delegate in actual residence of his district or Territory.

II. Each year, as soon after the 5th of March as possible, Members and Delegates shall be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress.

III. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy on the 11th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to reach the June examination, will be examined on the 22d of September following; should any candidate fail to report, or be found physically or mentally disqualified for admission, in June, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined on the 22d of September following. When any of the dates assigned for examinations fall on Sunday, the examination will take place on the following Monday.

A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting nominations attempting to enter a service for which they are not fitted.

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States approved July 27, 1880.

EXAMINATION.

IV. Each candidate for appointment as Cadet-Midshipmen must present to the Academic Board satisfactory testimonials of good moral character, and must certify on

honor to his precise age, which must be over fourteen and less than eighteen the time of the examination. No candidate will be examined whose age do within the prescribed limits.

VII. Candidates must be physically sound, well formed, and of robust con they will be required to pass a satisfactory examination before a medical b posed of the surgeon of the Naval Academy and two other medical officers igned by the Secretary of the Navy.

VIII. Any *one* of the following conditions will be sufficient to cause the r a candidate:

Feeble constitution, inherited or acquired;

Greatly retarded development;

Permanently impaired general health;

Decided cachexia, diathesis, or predisposition;

All chronic diseases or results of injuries that would permanently impair e
viz:

Weak or disordered intellect;

Cutaneous and communicable diseases;

Unnatural curvature of spine, torticollis, or other deformity;

Permanent inefficiency of either of the extremities or articulations from an Epilepsy or other convulsions within five years;

Impaired vision or chronic disease of the organs of vision;

Great hardness of hearing or chronic disease of the ears;

Chronic nasal catarrh, ozena, polypi, or great enlargement of the tonsils;

Impediments of speech to such an extent as to impair efficiency in the perf
of duty;

Chronic diseases of heart or lungs or decided indications of liability to ca
pulmonary affections;

Hernia or retention of testes in inguinal cavity;

Sarcocoele, hydrocele, stricture, fistula, or hæmorrhoids;

Large varicose veins of lower limbs, scrotum, or cord;

Chronic ulcers.

Attention will also be paid to the stature of the candidate, and no one ~~ma~~
under size for his age will be received at the Academy. In the case of doubt ab
physical condition of the candidate, any marked deviation from the usual stan
height will add materially to the consideration for rejection. Five feet will
minimum height for the candidate.

The board will exercise a proper discretion in the application of the above
tions to each case, rejecting no candidate who is likely to be efficient in the
and admitting no one who is likely to prove physically inefficient. No can
rejected by the board will be allowed a re-examination, and when rejected the d
ment will not reverse the action of the board.

IX. The candidates must pass a satisfactory examination before the Academic
in reading, writing, spelling, arithmetic, geography, and English grammar.

X. All the examinations, except in reading, will be written. Candidates
below the standard will receive a second and final examination in the subjects
they fail. Deficiency in any one of the subjects at the second examination
sufficient to insure rejection.

XI. "Candidates rejected at such examinations shall not have the priv
another examination for admission to the same class unless recommended by th
of Examiners."—(*Rev. Stat.*, § 1515.)

GENERAL CHARACTER OF THE QUESTIONS.

XII. ARITHMETIC.—*Notation and numeration.*—The candidate is required to
in figures any whole number, decimal, or mixed number, to write in words an
number, and to explain the Roman and Arabic systems of notation.

Denominate numbers.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

Fractions.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such processes, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

Properties of numbers.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as of small numbers.

Ratio and proportion.—Definitions and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

Percentage, interest, and discount.—Examples usually given under these heads in arithmetic.

Mensuration.—The measurement of rectangular surfaces and volumes.

Evolution.—The extraction of square and cube roots.

Analysis.—Miscellaneous problems usually classed under this head, similar to those and in school arithmetics. It is essential that the candidate should be thoroughly efficient in all branches of arithmetic; unusual excellence in this will be allowed to count in his favor in case of a slight deficiency in other subjects.

Should persons intending to present themselves as candidates acquire a knowledge of algebra, it will be found to be of material assistance in the course of study pursued at the Academy, although not required for admission.

When practicable, should the candidate so prefer, algebraic solutions of problems may be substituted for arithmetical solutions.

GEOGRAPHY.—Candidates will be questioned on the grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains and

locality of important peaks; the position and course of rivers, their tributaries, the bodies of water into which they empty; the position of important seas, bays, straits, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes, and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance (attention is specially called to the rivers and bodies of water in which cities are situated); the course of a vessel in making a voyage between the known sea-ports.

GRAMMAR.—Candidates will be examined in the whole of English grammar as stated in the common-school text-books, embracing the following subjects: The divisions of letters and the use of capitals; the parts of speech; the classification of nouns, and the distinctions of person, gender, and number; under *number*, the rules for the formation of the plural, nouns irregular and defective in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite article, and the use of *a* or *an*; the classification of *adjectives*; the explanation of the different degrees of comparison; the rules for *comparing adjectives*; irregular and defective comparison; numerals and their classification; the double classification of pronouns, first, into substantives and adjectives; secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as the difference between *my* and *me*, between *thou* and *you*, and the various uses of *it*; compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective

pronouns, or pronominal adjectives, and their classification; the classified conjugation of *verbs*; the relations between transitive and intransitive verbs; principal parts of regular, irregular, and defective verbs; the uses and inflections of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, person; tense endings and personal endings; impersonal verbs; the classification, and comparison of *adverbs*; conjunctive adverbs; the use of *prepositions*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, giving syntax.

Parsing, according to the following model; giving in the case of each word an explanation of its grammatical relation to the other words in the sentence.

Noun: Class, gender, number, person, case.

Article: Definite or indefinite; qualified noun.

Adjective: Class, compared or not compared; comparison, if admitting it or comparison; qualified noun.

Personal pronoun: Person, gender, number, case.

Relative pronoun: Person, gender, number, case, antecedent.

Interrogative pronoun: Gender, number, case.

Adjective pronoun (or pronominal adjective): Class; qualified word.

Verb: Class, form, principal parts, tense, mood, voice, person, number, subject.

Adverb: Class, derivation and comparison, if derived and compared; qualified word.

Preposition: Words between which the relation is shown by the preposition.

Interjection: The kind of emotion expressed.

Conjunction: Class; words or sentences connected.

READING.—Candidates will be examined in reading aloud English prose.

WRITING AND SPELLING.—Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use.

An examination in English branches containing eight or more mistakes in spelling will not be considered satisfactory, and will be sufficient of itself to cause the rejection of the candidate.

ADMISSION.

XIII. Candidates who pass the physical and mental examinations will receive appointments as Cadet-Midshipmen, and become inmates of the Academy. Each will be required to sign articles by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy), unless sooner discharged. The pay of a Cadet-Midshipman is \$500 a year, commencing at the date of his admission.

XIV. Cadets, immediately after their admission, will supply themselves with the following articles; viz.,

One parade-suit.....	\$37 72	* Eight pairs socks.....
One undress suit.....	20 95	* Four pairs drawers.....
One working-suit.....	2 42	* Six handkerchiefs.....
One overcoat.....	23 30	* Eight towels.....
One rubber coat.....	3 68	Two pairs drill gloves.....
One pair rubber leggings.....	1 05	Two pairs Lisle thread gloves.....
Two pairs white duck leggings....	2 34	* One pair suspenders.....
One pair gymnastic slippers.....	92	One neck-tie.....
One parade-cap.....	3 69	Two clothes-bags.....
One undress-cap.....	1 71	One hair mattress.....
* Two pairs high shoes.....	11 50	One straw mattress.....
* Eight white shirts.....	10 00	One hair pillow.....
* Two nightshirts.....	1 76	One pair blankets.....
* Four undershirts.....	2 24	Two bedspreads.....
Twelve linen collars.....	1 68	Six sheets.....

Four pillow-cases	\$1 00	One pass-book	\$0 27
*One tooth-brush	20	One stencil ink and brush	41
*One hair-brush	40	One bottle indelible ink	17
*One whisk	15	One rug	1 44
*One coarse comb	11	One wash-basin and pitcher	1 05
*One fine comb	34	One looking-glass	95
One mug	10	One water-pail	70
*One cake soap	10	One sloop-bucket	70
One soap-dish	10	One broom	27
One requisition-book	32		
One laundry-book	25	Total	185 00

The articles marked *, not being required to conform to a standard pattern, may be brought by the cadet from home, but all other articles must conform to the regulations, and must, therefore, be supplied by the storekeeper.

Each Cadet-Midshipman must, on admission, deposit with the paymaster the sum of \$20, for which he will be credited on the books of that officer, to be expended by direction of the Superintendent, in the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing and the entrance-deposit of twenty dollars must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES

Deposit for clothing	\$165 00
Deposit for books, &c.	20 00
Total deposit required	185 00

The value of clothing brought from home is to be deducted from this amount.

Each Cadet-Midshipman, *one month after admission*, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XV. A Cadet-Midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling expenses.

WILLIAM H. HUNT,
Secretary of the Navy.

EXAMINATION OF CANDIDATES FOR ADMISSION AS CA MIDSHIPMEN, 1881.

ARITHMETIC.

SEPTEMBER, 1881.—Time allowed, three hours.

1. Divide .765439 by 359.21 to five decimal places. Simplify $\frac{4.255 \times .0064}{.000032}$. Find value of $\frac{1}{3.1415926}$ to seven decimal places. Find what decimal part 117 $\frac{1}{2}$ yards 9 inches is of 3 miles 3 furlongs 32 yards 8 inches.
2. Write down the *prime* factors of 13013, 798, 48441, 22011, and 5929. (None factors are greater than 30.)
Simplify $4\frac{1}{2} + 5\frac{1}{3} + 6\frac{1}{4}$ of $9\frac{1}{2} + 10\frac{1}{3} + 11\frac{1}{4}$
 $\frac{1}{7\frac{1}{2}} + \frac{1}{8\frac{1}{2}} + 9\frac{1}{4}$ of $\frac{1}{1\frac{1}{2}} + \frac{2}{1\frac{1}{6}} + \frac{1}{3\frac{1}{2}}$.
3. Multiply £45 12s. 6 $\frac{1}{2}$ d. by 12 $\frac{1}{2}$ s. Divide 345 lb. 9 oz. 16 dwt. 20 gra. by Find the interest on £512 16s. 8d. for 3 years 7 months 21 days at 4 $\frac{1}{2}$ per cent.
4. Find the square root of .0288 to seven decimal places and the cube root of to five decimal places.
5. English sovereigns (pounds sterling) are coined from standard gold which tains 11 parts pure gold to 1 part alloy. Forty lbs. Troy of this metal are coined 1869 sovereigns: what is the value in English money of a double eagle which w 516 grains, and is composed of 9 parts pure gold to 1 part alloy? What is the in U. S. money of the English sovereign?
6. By what factor less than 1000 must 5789 be multiplied that the last three of the product may be 009? Explain your method. If the interest on \$575 at cent. be equal to the discount on \$6176.25 for the same time at the same rate, at the latter sum due?

ENGLISH BRANCHES.

SEPTEMBER, 1881.—Time allowed, three hours.

DICTATION.

These concluding words are of dangerous implication, and, certainly, it was the intention of Edward, inferior to none of his predecessors in the love of power, to himself of that eminent prerogative which, although illegally, had been asserted by them all. But the Parliament took no notice of this reservation and acted with unshaken perseverance to insist on this incontestable and fundamental which he was prone enough to violate.

The proper business of the House of Commons was to petition for the redress of grievances as much as to provide for the necessities of the Crown. The throne was fixed upon a pinnacle which perpetual beams of truth and justice irradiated; but corruption and partiality may occupy the middle region and cast their shadows upon all below.

SPELLING.

Jeopardy.	Cinnamon.	Accelerate.	Liquidate.
Irretrievable.	Elementary.	Tennis.	Phraseology.
Isosceles.	Alimentary.	Tyrannical.	Veteran.
Ethereal.	Britannia.	Worsted.	Diffidence.
Indigenous.	Cemetery.	Enamel.	Horizon.
Crevice.	Albatross.	Miscellany.	Javelin.

GRAMMAR.

I. (1) Give the principal parts (all forms) of seek, awaken, feel, dream, tread, cleave, set. (2) Give the possessive singular and plural of fancy, barley, abyss, mirage, echo. (3) Compare late, little, fore, beautiful. Define case, personal pronoun, infinitive mood.

II. Correct the following passage, and explain all the corrections: "My brother lives most all of nine miles from Topeka: it's sort of lonesome out there, and I reckon he don't like it much. You see it's considerable of a ways to go, but I'd as lives go as not."

III. Parse the words in italics: "*Nerer* within the memory of the *oldest*, not even *on that* night when *it* was known *that* the army *had* declared for the Parliament *that* had saved England, *had there* been *such* rejoicing."

GEOGRAPHY.

I. Give an account of the lakes, mountains, and river-valleys of Switzerland, showing their relative position and direction.

II. Where and on what water are the following: 1. Pembina. 2. Free Town. 3. Disco. 4. Rangoon. 5. Beirut (or Beyrout).

III. Name the capitals of England, Scotland, and Ireland, telling on what water each one is. Name the chief ship-building ports; the commercial ports; naval ports; manufacturing towns; capes; and fix the position of each.

IV. Name, fix position, and describe as fully as possible any three of the great river-deltas of the world.

V. What are the great feeders of the Caspian Sea? the Sea of Aral? Lake Winnipeg? Ohio River? (Name five of the last.)

RE-EXAMINATION.

ARITHMETIC.

SEPTEMBER, 1881.—Time allowed, three hours.

1. A yard being equal to .914 of a metre, what is the length of the metre in inches? (Four decimal places.)

2. What common fraction of a year of $365\frac{1}{4}$ days is 27 days 16 hours 29 minutes 4 seconds? (The fraction is to be in its lowest terms.)

3. Simplify $\frac{120 - \frac{1}{119} - \frac{1}{239}}{1 + \frac{1}{239}}$ of $\frac{120}{119}$ and $\frac{\frac{1}{40} + \frac{8}{27} + \frac{64}{125}}{\frac{1}{4} + \frac{4}{9} + \frac{16}{25} - \frac{19}{15}}$.

4. Find the cost of 36 miles 3 furlongs 22 yards of wire at £14 13s. 4d. per mile.

5. Find the interest on £395 14s. 6d. for 2 years 5 months 20 days at $3\frac{1}{4}$ per cent.

6. Write the prime factors of 2401, 143143, 47311, 10985, and 94871.

7. If 8 lbs. 1 oz. 19 dwts. 9 grains cost £10 6s. 6d., what will be the cost of 13 lbs. 7 oz. 5 dwts.?

8. Find the square root of $3\frac{1}{4}$ to six decimal places.

9. Find the cube root of $\frac{3}{4}$ to six decimal places.

10. English shillings are coined from standard silver which contains 37 parts of silver to 3 parts of alloy; one pound of this metal is coined into 66 shillings. Find the value of the English shilling in United States silver money, given that the United States dollar weighs 412.5 grains and consists of 9 parts of silver to 1 of alloy.

ENGLISH BRANCHES.

SEPTEMBER, 1881.—Time allowed, three hours.

DICTATION.

It was not apparently consistent with the primary object of retrieving the Christian affairs in Palestine to interfere in the government of a Christian empire; but the

temptation of punishing a faithless people and the hope of assistance in subsequent operations prevailed. They turned their prows up the Archipelago withstanding the vast population and defensible strength of Constantinople, which compelled the usurper to fly and the citizens to surrender. But animosities springing from religious schism and national jealousies were not likely to be allayed by such success. The Greeks, wounded in their pride and bigotry, regarded the legitimate emperor as a creature of their enemies.

SPELLING.

Isthmus.	Obelisk.	Technical.	Linear.
Incipient.	Rudiment.	Untenable.	Sustenance.
Prestige.	Aëronaut.	Conglomerate.	Curfew.
Fallacy.	Trestle.	Lucid.	Dentifrice.
Gazetteer.	Statistics.	Centennial.	Farinaceous.
Polygamy.	Skeleton.	Exorbitant.	Flagitious.

GRAMMAR.

I. (1) Explain the uses of the objective case. What verbs have distinctive voice? (2) Give the possessive plural of sea, valley, basis, stratum, bandit. (3) Give the principal parts of abide, cost, fling, grow. What is meant by mood? (4) Give the principal parts of gay, nigh, happy.

II. Correct, and explain corrections fully: It ain't likely as I am going to see who I see yesterday after I had gone and done it. I tell you it's me, and I don't talk like I was mad.

III. Parse the words in italics: They were always a strange *family*; they acted *like* other *people*; their hearts were in the right place, but their heads were *to be doing* anything *but what* they ought.

GEOGRAPHY.

1. Give an account of the West India islands, their names, relative position, size, important towns, and the names of the states to which they belong.

2. From what water and into what land do the following extend: 1. Georgia. 2. Delagoa Bay. 3. Chesterfield Inlet. 4. Gulf of Cutch. 5. Nauplia.

3. Where and on what water is Belgrade? Terre Haute? Ottawa? Madras?

4. Fix the position of the following capes, telling from what land, and into what water, they project: 1. Matapan. 2. Comorin. 3. Agulhas. 4. San Lucas.

5. Name and fix position of the following: 1. Three seaports of Italy. 2. Three mountain-ranges of Spain. 3. Three seaports of California.

REGULATIONS

FOR THE

POINTMENT OF CADET-ENGINEERS IN THE UNITED STATES NAVY.

In pursuance of law, applications will be received by the Navy Department for appointment of Cadet-Engineers.

I. The application is to be addressed to the Secretary of the Navy, and can be made the candidate or by any person for him, and his name will be placed on the registry.

The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

II. The number of appointments which can be made is limited by law to twenty each year. The candidate must not be less than sixteen or more than twenty years of age; he will be required to certify *on honor* to his precise age, to the Academic Board, previously to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of good moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September for examination as to their qualifications for admission.

III. The course of study will comprise four years at the Naval Academy, and two additional years at sea. All Cadets who finally graduate will be commissioned Assistant-Engineers in the Navy as vacancies occur. The pay of a Cadet-Engineer while at Naval Academy is \$500 per annum.

IV. The academic examination previous to appointment will be competitive, and will be on the following subjects, namely: Arithmetic; algebra, through equations of the second degree; plane geometry; rudimentary natural philosophy; reading; writing; spelling; English grammar; English composition; geography; free-hand drawing; and an elementary knowledge of the principles governing the action of the steam-engine. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal*, will have precedence for admission.

V. The examination before the Medical Board is the same as that of candidates for appointment as Cadet-Midshipmen. See page 56.

The following deposits must be made before a candidate can be received into the Academy:

clothing (see p. 58).....	\$165 00
books and drawing instruments.....	50 00
Total	215 00

VI. Persons who contemplate presenting themselves as candidates for admission as Cadet-Engineers are cautioned that the number of applicants is large, and the competition exceedingly close. It is, therefore, useless for candidates to present themselves unless well prepared on the subjects of the examination, and unless their physical qualifications are within the prescribed standard.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1881.

Number of competitors, 155.

ARITHMETIC.

Time allowed, three hours.

1. Reduce 3 miles 3 furlongs 30 yards 2 feet $1\frac{1}{2}$ inches to metres; given that $=39.37079$ inches. (Result to be accurate to three decimal places.) Multiply 3.14159 by 2.7182818285, the result to be accurate to seven decimal places.

2. A tank is 4 feet 4 inches wide, 5 feet long, and 2 feet 6 inches deep; how many gallons (231 cubic inches) of water will it contain? Suppose that in measurement quantity of water in this tank we allow that every 3 inches in depth gives 40 per cent. by what per cent. should the measurement be increased or diminished to be accurate? (Result to five places.)

3. Find the square root of 26.02 and the cube root of 4844, each to seven places.

4. Find the value, correct to seven decimal places, of $\frac{1}{7} + \frac{1}{3 \times 7^2} + \frac{1}{5 \times 7^3} + \frac{1}{7 \times 7^4}$

5. Find the interest on £896 7s. 6d. for 1 year 9 months at $4\frac{1}{2}$ per cent. The difference between the simple interest and the discount on a certain sum of money for 4 months at 8 per cent. is \$1.75; what is the sum? (Result to be exact.)

6. A can run a mile in 7 minutes 45 seconds; B can run $7\frac{1}{2}$ miles per hour; C the faster runner, and in a race which the faster wins in 15 minutes, how many miles must the loser be behind? If A runs a mile in x minutes and B runs x miles per hour, what must be the value of x so that the rates may be the same? (Five decimal places.)

ALGEBRA.

Time allowed, three hours.

1. Multiply $a^4 - 2a^2b^2 + 4a^2b^2 - 8ab + 16a^2b^3 - 32b^4$ by $a^2 + 2b^2$.

Simplify the fractions

$$\frac{a^3 + ab^2 - a^2b - b^3}{4a^4 - 2a^2b^2 - 4a^3b + 2ab^3} \text{ and } \frac{1 + x^2 + x - x^2}{2x + 2x^2 + 3x^3 + 3x^4}$$

2. Find the greatest common divisor of $(ab - ac + b^2 - bc)x + a^2c + ab^2 - a^2$ and $(b - c)x^2 + (2ab - 2ac)x + a^2b - a^2c$. Separate each of the above quantities into its factors. Find the value of y which will make $2(y^2 + y)x^2 + (11y - 2y^2 - 2y^3 + y^2)x^3 + (11y^2 - 2y)x^2 + (y^2 + 5y)x + 5y - 1$ have a common divisor.

3. Simplify $\frac{a^3(b^2 - c^2) + b^3(c^2 - a^2) + c^3(a^2 - b^2)}{a^2(b - c) + b^2(c - a) + c^2(a - b)}$.

What is the value of the expression when $a = b = c$?

4. Simplify $\frac{1 + \sqrt{3}}{2\sqrt{2} - 3\sqrt{3}}$. Find the square root of $13 + 2\sqrt{30}$.

Simplify
$$\frac{2 + \sqrt{3}}{\sqrt{2} + \sqrt{2} + \sqrt{3}} + \frac{2 - \sqrt{3}}{\sqrt{2} + \sqrt{2} - \sqrt{3}}$$

Solve the equations

$$\frac{a}{bx} + \frac{b}{ax} = a^2 + b^2, \quad \left\{ \frac{m}{x} + \frac{n}{y} = a, \quad \frac{n}{x} + \frac{m}{y} = b \right\},$$

$$\frac{4x-17}{x-4} + \frac{10x-13}{2x-3} = \frac{8x-30}{2x-7} + \frac{5x-4}{x-1}.$$

Reduce $x^6 - 5x^5 + 4x^4 - 3x^3 + 2x^2 - x + 1$ to the form $Ax + B$, by means of the equation $x^2 = 2x - 3$. Find the value of the above expression when $x = 5$, and show generally that its value when $x = a$ is the same as the remainder when it is divided by $-a$.

GEOMETRY.

Time allowed, two hours and a half.

- 1. Prove that the three bisectors of the angles of a triangle meet in a point. Prove that a bisector divides the opposite side into segments proportional to the adjacent sides. In an isosceles right triangle draw the bisectors, and find the distance from their common point to the hypotenuse, denoting the side by a .
- 2. Prove that if from a point without a circle two secants be drawn, the whole secants and the parts without the circle will be reciprocally proportional. State the proposition in another form in which the term *reciprocally proportional* is not used. Show how the proposition is modified when one of the secants becomes a tangent.
- 3. Prove that the area of a regular dodecagon inscribed in a circle is three times the area of the radius. Denoting the radius by b , find the length of a side of the dodecagon, and the area of the regular polygon of twenty-four sides inscribed in the same circle.
- 4. An octagon, side c , is to be formed from a square by cutting off the corners; what must be the side of the square? Show how the problem may be solved by a construction.
- 5. Chords are drawn from a fixed point in the circumference of a circle: find the locus of the middle points of the chords. Given a fixed chord in a circle, show how to draw, from a given point in the circumference, a second chord which shall be bisected by the first. From the obtuse angle of a triangle draw a line to the base which shall be a mean proportional between the segments of the base.

NATURAL PHILOSOPHY.

Time allowed, three hours.

- 1. How is the mass of a body measured? Define momentum and energy.
- 2. A weight of 24 pounds is suspended by two strings, one of which is horizontal and the other is inclined at an angle of 45° to the vertical: find the tension of each string.
- 3. Six vertical smooth posts are fixed in the ground at equal intervals round the circumference of a circle, and a cord without weight is passed twice round them all in the horizontal plane, and pulled together with a force of 100 pounds; find the magnitude and direction of the resultant pressure on each post.
- 4. A cylindrical vessel weighing 4 pounds and having an internal depth of 6 inches will just hold 2 pounds of water; the centre of gravity of the vessel when empty is 9 inches from the top: find the centre of gravity of the vessel and contents when full of water.
- 5. Determine the position of the centre of gravity of a triangle.
- 6. A man when weighed in a balance of the ordinary kind pushes with a walking-stick the beam of the balance at a point between the point of suspension of the scale-pan in which he stands and the fulcrum: determine what effect will be produced on his apparent weight.
- 7. How many pounds of water can an engine of 34 horse-power raise to the height of 376 feet in 5 minutes?

A weight of 8 cwt. is raised from a depth of 100 fathoms by means of a
ing 1 pound per foot: find the number of units of work expended.

5. A mass of 5 tons moves at the rate of 10 feet per second: find the
units of work accumulated in it. If the mass is acted on by a force of 2
the direction opposite to that of the motion, find how far it will move b
brought to rest.

6. Find the space described by a falling body in one-twentieth of a sec
ning at the end of two seconds.

Two balls are dropped from the same point at different instants: show t
fall, the distance between them increases directly with the time.

7. A body whose specific gravity is 3.5 weighs 4 pounds in water: find
of the body.

A vessel contains mercury of specific gravity 13.6, on which floats a cube
specific gravity 7.2; water is poured into the vessel until the cube is comp
mersed: find what portion of the cube is below the surface of the mercury.

8. Determine the velocity of a body weighing 25 pounds when its ene
same as that of a body weighing 64 pounds, which is moving at the rate
per second.

Find the number of units of work expended in raising from the ground the
for building a uniform column 50 feet in height and 10 feet square, a cubic fo
materials weighing 112 lb. How high is the column when the work is half co

ENGLISH BRANCHES.

Time allowed, three hours.

DICTATION.

But this attendance in Parliament of inferior tenants-in-chief, some of t
poor to have received knighthood, grew insupportably vexations to them
was not well liked by the king. He knew them to be dependent upon the
and dreaded the confluence of a multitude who assumed the privilege of c
arms to the appointed place. So inconvenient and mischievous a scheme c
long subsist among an advancing people; and, fortunately, the true remedy
covered with little difficulty.

The principle of representation, in its widest sense can hardly be unknow
government not purely democratical. The system of ecclesiastical council
ered as organs of the church, rested upon the principle of a virtual or a
representation, and had a tendency to render its application to national as
more familiar.

SPELLING.

Coalition.	Parasite.	Aggregate.	Epidemic.
Adjustment.	Recreant.	Automatic.	Loathe.
Supplementary.	Heir-apparent.	Chronology.	Devastate.
Derision.	Monetary.	Readable.	Bi-metallic.
Consecutive.	Chancellor.	Reminiscence.	Cabal.
Cynicism.	Tenet.	Exchequer.	Instigate.

GRAMMAR.

I. (1) Give the principal parts of hit, abide, lie, spread, lay, burst, do
State the number (singular or plural) of strata, effluvia, vertebra, errata, nel
Give the plural of commander-in-chief, talisman, ephemeris, focus, genus, s

II. Correct the faults in the following, and explain the corrections: "Bet
and I, I expect I hadn't ought to have done it. I ain't ashamed of it, the
cause most everybody is afraid of those kind of things."

III. Parse the words in italics: *What* had become of *that* other ship *was* never *known*; but it was supposed *that* she had gone down with *all* on board. The *ship* that was *saved* was the *Seahorse*.

GEOGRAPHY.

I. In what part of what country, and on what water, are the following: 1. Tucson. 2. Metz. 3. Kiev. 4. Callao. 5. Monaco. Tell which, if any, are capitals.

II. Name the four provinces of Ireland, show their relative position, and name the principal seaport in each.

III. Bound Servia; bound Roumania. Where and what is Bulgaria?

IV. Name the three principal isthmuses upon which it is proposed to provide a means of communication between the Atlantic and Pacific Oceans, and name in each case the state to which the territory belongs. Name in order the states of Central America, stating on what water each has a coast line.

V. Describe the following rivers, telling where they rise, in what direction they flow, and into what water they empty: 1. Madeira. 2. Main. 3. Syr-Daria. 4. Brazos.

all purposes on shipboard; measuring for and fitting standing masting, sparring, and rigging ship; getting on board and organizing a ship's company; the fittings of boats; the man all circumstances; evolutions of vessels at sea and in harbor; ging in cases of accident; duties of officers at sea and in port; and weather.

Text-book.—Luce's Seamanship, with lectures and illustrations.
SHIP-BUILDING.

Text-books.—Thearle's Naval Architecture and Wilson's Ship illustrated by models and drawings.

NAVAL TACTICS.*—Organization, formations, and manœuvres steam or sail.

Text-books.—Manual of Naval Tactics (Ward); Steam Fleet Tactics; States Naval Signal-Book; Manual of Signals (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP-DRILLS.*—Exercises on shipboard with sails and

NAVAL TACTICS.*—Exercises in boats under oars and under

SIGNALS.—Exercises in the use of signals according to Myer's

PRACTICAL SEAMANSHIP.*—Exercises on board the United States on Saturday mornings.

The instruction in boxing, gymnastics, swimming, and dancing department.

DEPARTMENT OF ORDNANCE AND GUNNERY

PRACTICE AND THEORY OF GUNNERY.*—*Practical naval gunnery* the Ordnance and Gunnery Instructions for the United States.

Preparation of gun-iron from crude ore, including the descriptions; manufacture of wrought-iron, steel, and bronze; fabric descriptions; manufacture of gunpowder and fuses, and of all fire-works.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target practice on board the United States ship *Santee*.

MORTAR-PRACTICE.

FENCING.—Exercises with small-swords and broadswords.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and conversion of fractional and surd quantities; involution and evolution; reduction and solution of equations of the first and second degrees; the summation of series; the nature, construction, and use of logarithms; the theory of equations.

GEOMETRY.—Plane and solid geometry; the mensuration of surfaces and volumes; the application of algebra to geometry.

TRIGONOMETRY.—Analytical investigation of trigonometric formulas, and their application to all the cases of plane and spherical trigonometry; the construction and use of trigonometric tables; the solution of trigonometric equations; trigonometric series.

ANALYTICAL GEOMETRY.—Equations of the right line, plane, and conic sections; discussion of the general equation of the second degree, involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the application of the method, particularly to the projections of the sphere and to the construction of maps.

Text-books.—Ray's Higher Algebra; * Todhunter's Algebra for beginners; † Chauvenet's Geometry; * Wentworth's Geometry; † Chauvenet's Trigonometry; Church's Descriptive Geometry; Angell's Practical Geometry and Projections; * Todhunter's Conic Sections; Aldis' Solid Geometry; * Bowditch's Useful Tables.

ELECTIVE COURSES.

In addition to the above, Cadets of the third and fourth classes who display marked ability in mathematics are permitted to take an advanced course. The following are the elective courses for 1880-'81:

Fourth class.—Algebra, the theory of equations, and curve-tracing.

Third class.—The elements of the differential and integral calculus, with applications to trigonometry and to geometry of two dimensions.

Text-books.—Todhunter's Algebra for Colleges and Schools; Todhunter's Theory of Equations; Rice and Johnson's Elements of the Differential Calculus; Johnson's Integral Calculus.

DEPARTMENT OF STEAM-ENGINEERING.

MARINE ENGINES.—General theory of the steam-engine; classification and details of marine steam-engines, and of instruments and apparatus used in connection with them; the computation of the power and its cost; instruction in the duties of the engine-room watch and of the engineer division, by means of practical exercises on board the United States steamer *Nantucket*.

MANUFACTURE OF MACHINERY.—The qualities and strength of materials, and the processes of manufacture, accompanied by practical exercises with the workshop methods and appliances for the conversion of the various materials into finished machinery.

DESIGNING OF MACHINERY.—Pure mechanism, and the designing of boilers and engines, including valve-gears.

* Cadet-Engineers only.

† Cadet-Midshipmen only.

ASTRONOMY.—Descriptive and practical astronomy, including instruments, especially those used for determining terrestrial latitude; solution of the astronomical triangle; the use of the Nautical Almanac.

Text-books.—C. J. White's Astronomy; Newcomb and Holden's Astronomy; of the portable Transit and the Zenith Telescope; Coffin's Nautical Navigator.*

NAVIGATION.*—Theory and practice of navigation, the latter especially in the duties of the navigator, the use of navigating instruments, with the solution of problems and the use of tables.

Text-books.—Coffin's Navigation; * Howell's Mathematical Tables; of the Compass; * Bowditch's Navigator; * Howell's Marine Surveying.

SURVEYING.*—The form of the earth, with special reference to geodesy; explanation of geodetical surveys; the solution of problems in surveying, and practical work in surveying and constructing charts.

Text-book.—Howell's Marine Surveying.*

DEPARTMENT OF PHYSICS AND CHEMISTRY

ACOUSTICS.—Theory of waves; the production and propagation of sound; numerical evaluation of sound; modes of vibration; communication of vibrations.

OPTICS.—The propagation, reflection, and refraction of light; optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

ELECTRICITY AND MAGNETISM.—Statical electricity; dynamical electricity; electro-magnetism; electrical measurements; thermo-electricity.

CHEMISTRY.—General Chemistry.

EXPERIMENTAL LECTURES ON PHYSICS AND CHEMISTRY.

HEAT.—Theories of heat; sources of heat; conduction, radiation, and convection; specific heat; effects of heat; instruments used for the measurement of heat; thermodynamics.

quantities of Na Cl in solution; photometric observations; experiments with the spectroscope, saccharimeter, and diffraction bank; measurements of the resistance of batteries of various forms and working under different conditions; comparison of the resistances of the various sets of resistance coils in the laboratory; determination and comparison of the constants of three tangent galvanometers; an investigation of the changes in electrical resistance of carbon due to changes in pressure.

The work in the chemical laboratory during the year 1879-'80 embraced blowpipe analysis; crystallography; mineralogy; quantitative analysis.

The course in mineralogy comprised the study in the mineral cabinet of the most commonly-recurring minerals, the useful ores, and the objectionable minerals which are frequently associated with them.

The course in quantitative analysis consisted of the gravimetric determination of—Iron in ammonio-ferrous sulphate.

Lead, carbon dioxide, and insoluble residue in a white lead ground in oil.

Valuation of a coal.

The preparation and standardizing of a solution of potassic permanganate by means of iron wire, ammonio-ferrous sulphate, oxalic acid, and ammonic oxalate.

The estimation of iron in an iron salt and in hematite and magnetite ores by means of the permanganate solution.

Preparation and standardizing of a solution of potassic dichromate.

Estimation of iron in an iron salt by Penny's method.

Text-books.—Stewart's Elementary Physics; Eliot and Storer's Chemical Analysis; Rankine's Magnetism and Electricity; Stewart's Elementary Treatise on Heat; Miller's Organic Chemistry; Kohlrausch's Physical Measurements; Nason and Chandler's Blowpipe Analysis; Dana's Manual of Mineralogy; Thorpe's Quantitative Chemical Analysis.

Cadet-Engineers of the first class have additional practical exercises in chemical analysis every Saturday morning, while the Cadet-Midshipmen exercise in seamanship.

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

THE DIFFERENTIAL AND INTEGRAL CALCULUS.—The principles of the differential calculus, including Taylor's theorem, applications to problems of maxima and minima, and the tracing of curves; the methods of integration, and the application of the integral calculus to areas, surfaces, and volumes, and to finding centres of gravity and moments of inertia, and to simple cases of differential equations.

MECHANICS.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work and the conservation of energy.

HYDROSTATICS.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aëriiform fluids.*—Laws of pressure; weight and pressure of the atmosphere; the barometer, the siphon, and the pump.

THE STRENGTH AND RESISTANCE OF MATERIALS.*—Simple and compound stresses; the relations between strain, stress, and resilience; the strength and stiffness of beams; beams of uniform resistance.

THE METHOD OF LEAST SQUARES.*—The theory of the method of least squares and the application of the method to results derived from experiments.

THEORETICAL NAVAL ARCHITECTURE.*

Text-books.—Rice and Johnson's Differential Calculus; Johnson's Integral Calculus; Rodhunter's Mechanics for Beginners; Smith's Hydrostatics; Alexander's Applied Mechanics;* Rankine's Applied Mechanics;* Merriman's Method of Least Squares;* Hearle's Theoretical Naval Architecture.*

*Cadet-Engineers only.

ELECTIVE COURSES.

Cadets who have completed the elective course in mathematics are permitted an advanced course in the integral calculus and in analytical mechanics.

The course in theoretical naval architecture is elective for Cadet-Midshipmen. There is also an elective course in theoretical naval architecture for Cadet-Lieutenants.

Text-books.—Williamson's *Integral Calculus*; Tait and Steele's *Dynamics*; Thearle's *Theoretical Naval Architecture*; *Lectures on the mathematics of naval architecture*.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW

LAW.—Constitution of the United States.—International law; rights and nations in peace and war; rights of interference, of jurisdiction over the sea, of passage over land and navigable rivers; duties of ministers, consuls, and naval commanders; kinds of property liable to capture; domicile; privateering; rights of neutrals; contraband; blockade; rights of ship's papers; offenses against the law of nations.—*Outlines of maritime law*.

Text-books.—Woolsey's *International Law*; Andrew's *Manual of the Constitution*.

HISTORY.—*Outlines of history*, especially the history of Greece and Rome, and the states of Western Europe down to 1880; historical geography; progress of development in America; history of the United States; naval history; contemporary European and American history; lectures.

Text-books.—Freeman's *General Sketch of History*, with Labberton's *English Atlas*; Eliot's *History of the United States*, with modern atlases; the School History.

ENGLISH.—Historical development of the English language; changes and foreign influence on the grammar, vocabulary, and pronunciation. Etymology; analysis of sentences.—Readings from standard authors.—Rhetoric.—Translation of official dispatches.

Text-books.—Hill's *Rhetoric*; Tancock's *English Grammar and Reading Book*; *Manual of Punctuation*.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.—Grammar; exercises in reading, writing, and conversation.

SPANISH.—The course in Spanish is elective.

Text-books.—Keetel's *French Grammar*; La Fontaine's *Fables*; Prud'homme's *Nautical Phrases*; Erockmann-Chatrian's *Le Conscriit and Waterloo*; Gasc's *Dict. Roget's Spanish Manual*; Tolon's *Reader*; Barretti's *Dictionary*.

DEPARTMENT OF DRAWING.

Free-hand drawing and practical perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadets are placed in four classes, each class pursuing the course for the corresponding year.

PROGRAMME OF RECITATIONS.

me devoted to daily recitations is divided into three periods, indicated thus: (1), (2), (3). (1) first period, from 8.16 a. m. to 10.16 a. m.; (2) denotes second period, from 10.31 a. m. to 12.35 and (3) denotes third period, from 2 p. m. to 4 p. m.
cal exercises begin on Saturdays at 10.45 a. m., and on other days, except Sundays, at 4.05 p. m.

FIRST TERM.

From October 1, 1881, to January 28, 1882.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS.		
atics	M. T. W. Th. F. (2) S. (1) . . .	Algebra and geometry. Elective course once a week.
Studies, History, and Law.	M. T. W. Th. F. (1)	English and history.
Languages	First division, T. Th. (3) . . .	Keetel's French Grammar.
	Second division, W. F. (3) . . .	
g	First division, W. F. (3) . . .	Free-hand drawing.
	Second division, T. Th. (3) . . .	
	M. (3)	
THIRD CLASS.		
atics	M. T. W. Th. F. (1)	Trigonometry and descriptive geometry. Elective course once a week.
	F. (3)	Descriptive geometry.
and Chemistry	W. (3)	Elementary physics and chemistry.
Studies, History, and Law.	M. T. Th. (3)	English and history.
Languages	M. W. F. (2)	French and elective course in Spanish.
g	T. Th. (2) S. (1)	Topography.
SECOND CLASS.		
ship	Th. (3)	Luce's Seamanship.
ce and Gunnery	F. (3)	Infantry tactics and Ordnance Instructions.
my, Navigation, and Sur- g	M. (2) T. (3) S. (1)	Astronomy.
ics and Applied Mathe- s	M. W. Th. F. (1) T. (2)	Calculus. Elective course twice a week.
Studies, History, and Law.	W. (2)	English and history.
Languages	M. (3) Th. (2)	French and elective course in Spanish.
and Chemistry	F. (2) W. (3) T. (1)	Chemistry and heat.
FIRST CLASS.		
ship	T. (3) F. (1)	Ship-building.
	M. (3) W. (2)	Luce's Seamanship.
ce and Gunnery	Th. S. (1) F. (2)	Ordnance and armor.
ngineering	W. Th. F. (3)	Marine engines.
my, Navigation, and Sur- g	M. T. W. (1)	Navigation.
and Chemistry	M. T. Th. (2)	Electricity.

CADET-ENGINEERS.

Departments.	Periods.	Subje
FOURTH CLASS.		
Mathematics	M. T. W. Th. F. (2) S (1)	Algebra, geom scriptive geom tive course on
Steam-Engineering	M. T. W. (3)	Mechanical dra rication.
English Studies, History, and Law.	M. T. W. Th. F. (1)	English and hist
Modern Languages	Th. F. (3)	Keetel's French
THIRD CLASS.		
Mathematics	M. T. W. Th. F. (1)	Trigonometry as geometry. El once a week.
Steam-Engineering	W. (3) T. Th. (2) F. (3) S. (1)	Descriptive geom Mechanical draw rication.
English Studies, History, and Law.	M. T. Th. (3)	English and hist
Modern Languages	M. W. F. (2)	French and elect Spanish.
SECOND CLASS.		
Steam-Engineering	M. (2) T. Th. F. (3)	Mechanical draw rication of mac marine engines.
Mechanics and Applied Mathe- matics.	M. W. Th. F. (1) T. (2)	Calculus. Elect twice a week.
English Studies, History, and Law.	W. (2)	English and histor
Modern Languages	M. (3) Th. (2)	French and electiv Spanish.
Physics and Chemistry	F. (2) T. S. (1) W. (3)	Chemistry and heat
FIRST CLASS.		
Seamanship	T. (3) F. (1)	Ship-building.
Steam-Engineering	M. T. W. Th. S. (1) W. Th. F. (3) .	Marine engines, fi designing machin mechanical drawin
Physics and Chemistry	M. (3) T. Th. (2)	Electricity.
Mechanics and Applied Mathe- matics	M. W. F. (2)	Strength of material

SECOND TERM.

From January 30, 1882, to June 1, 1882.

CADET-MIDSHIPMEN.

Departments.	Periods.	Subjects.
FOURTH CLASS.		
tics	M. T. W. Th. F. (2) S. (1) . . .	Algebra and geometry. Elec tive course once a week.
Studies, History, and Law.	M. T. W. Th. F. (1)	English and history.
Languages	First division, T. Th. (3)	French.
	Second division, W. F. (3)	
	First division, W. F. (3)	Free-hand drawing and to pography.
	Second division, T. Th. (3)	
	M. (3)	
THIRD CLASS.		
tics	M. T. W. Th. F. (1)	Analytical geometry. Elec tive course once a week.
	T. (3)	Descriptive geometry.
and Chemistry	T. Th. F. (2) W. (3)	Elementary physics.
Studies, History, and Law.	M. Th. (3) S. (1)	English and history.
Languages	M. W. (2) F. (3)	French and elective course in Spanish.
SECOND CLASS.		
ip	W. F. (3)	Luce's Seamanship.
	Th. (2)	Naval tactics.
and Gunnery	T. Th. (3)	Infantry tactics and Ord nance Instructions.
ly, Navigation, and Sur s and Applied Mathe s	F. (2) S. (1)	Astronomy.
	M. T. W. Th. F. (1)	Mechanics. Elective course twice a week.
Studies, History, and Law.	One period a month	English composition.
Languages	M. (3) T. (2)	French and elective course in Spanish.
nd Chemistry	M. W. (2)	Heat.
FIRST CLASS.		
ip	M. W. (2)	Luce's Seamanship.
and Gunnery	W. (3) F. S. (1)	Ordnance and armor
ngineering	M. Th. (3) T. (2)	Marine engines.
ly, Navigation, and Sur s and Applied Mathe s	M. T. W. Th. (1)	Navigation and surveying.
	T. (2)	Elective course in naval archi tecture.
Studies, History, and Law.	T. F. (3)	Public Law.
Languages	Th. F. (2)	French and elective course in Spanish.

CADET-ENGINE

Departments.	Period
FOURTH CL	
Mathematics	M. T. W. Th. F. (2)
Steam-Engineering	M. (3) W. F. (3)
English Studies, History, and Law.	M. T. W. Th. F. (1)
Modern Languages	T. Th. (3)
THIRD CL	
Mathematics	M. T. W. Th. F. (1)
Steam-Engineering	W. (3) T. (3)
Physics and Chemistry	T. Th. F. (2)
English Studies, History, and Law.	M. Th. (3) S. (1)
Modern Languages	M. W. (2) F. (3)
SECOND CL	
Steam-Engineering	T. W. (3) Th. F. (2)
Physics and Chemistry	M. W. (2)
Mechanics and Applied Mathematics	M. T. W. Th. F. (1)
English Studies, History, and Law.	One period a month
Modern Languages	M. (3) T. (2)
Astronomy, Navigation, and Surveying	Th. F. (3)
FIRST CL	
Steam-Engineering	M. T. W. Th. F. (1)
Physics and Chemistry	T. (2) Th. (3)
Mechanics and Applied Mathematics	M. W. (3) M. W. (2) S. (1)
English Studies, History, and Law	T. F. (3)
Modern Languages	Th. F. (2)

EXAMINATION PAPERS—1880-81.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

MONTHLY EXAMINATION.

CADET ENGINEERS.

NOVEMBER, 1880.—*Time allowed, two hours.*

What is a root of an equation? Prove that if $f(x)$ is divisible by $x-a$, then a is a root of $f(x)=0$. Show that $f(a)$ is the remainder obtained by dividing $f(x)$ by $x-a$. Noting the roots of an equation by a, b, c , &c., find the coefficients of the equation in terms of the roots. Prove that imaginary roots occur in pairs. Find the value of $-7x^3-6x^2-5x+4$, when $x=11$.

What is Descartes' rule of signs? Transform the equation $x^3-6x^2+9x-10=0$, whose roots are a, b , and c , (1) to another whose roots are $-a, -b, -c$; (2) to one whose roots are $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$; (3) to an equation of the form $x^2+qx+r=0$; (4) to an equation of the form $x^2+px+r=0$ (two results). Transform the equation

$$x^3+2x^2+\frac{x}{4}+\frac{1}{9}=0 \text{ to another with integral coefficients.}$$

Explain the method of transforming an equation to another whose roots are less or more a given quantity. Determine the law of Derived Polynomials. Give a brief explanation of Horner's Method.

Find a root of $x^3-8x^2+23x-30=0$ to seven decimal places.

Solve the equation $x^3+qx+r=0$ (i. e., apply the method of Cardan). Find the condition that $x^3+qx+r=0$ may have equal roots.

Solve the equation $ax^3+bx+c=0$. What is the condition that the roots may be rational? Solve the equation $x^4+4x^3-10x^2+4x+1=0$.

The roots of $x^3+qx+r=0$, being a, b, c ; find the equation whose roots are $-b^2, (a-c)^2, (b-c)^2$, and from the results find the condition that the given equation may have a pair of equal roots.

Prove that $f(x)=f(x)\left\{\frac{1}{x-a}+\frac{1}{x-b}+\frac{1}{x-c}+\dots\right\}$ and then show that if $f(x)$ be divided by $f(x)$ the coefficients of the terms of the quotient taken in order shall be S_1, S_2, S_3, S_4 , &c., ... S_n , where S_n means the sum of the n th powers of the roots.

ALGEBRA.

CADET-MIDSHIPMEN.

JANUARY, 1881.—*Time allowed, four hours.*

Separate into factors $a^3-x^3, a^3+x^3, x^2-6x+5, 32a^4+54ab^3-81b^4, +2abc^2-a^2c^2-b^2c^2, ax^2-ab^2+b^2x-x^3$ and $a^3+b^3+c^3-3abc$.

Find the greatest common divisor of $2x^4-12x^3+19x^2-6x+9$ and $-18x^4+19x-3$.

Separate $4a^2b^2-(a^2+b^2-c^2)^2$ into four factors.

3. Solve the equations $\frac{x-1}{x-2} - \frac{x-2}{x-3} = \frac{x-5}{x-6} - \frac{x-6}{x-7}$ and $\frac{x}{a} - \frac{x}{a-b} = \frac{a}{a+b}$

4. Solve the equation $\frac{3abc}{a+b} + \frac{a^2b^2}{(a+b)^2} + \frac{(2a+b)b^2x}{a(a+b)} = 3cx + \frac{bx}{a}$.

5. Solve the equations $\frac{n}{x} + \frac{m}{y} = 1$, $\frac{m}{x} + \frac{n}{y} = 1$

and

$$ax - by = c(a-b), \quad \frac{x}{b+c} + \frac{y}{a+c} = 2.$$

6. Find the cube root of 7190 to seven decimal places.

7. Find the square root of $4 + 2\sqrt{3}$ and of $16 + 5\sqrt{7}$.

Simplify $\sqrt{\frac{2-\sqrt{3}}{2+\sqrt{3}}}$. Solve the equation $\sqrt{x+a} + \sqrt{x+b} = \sqrt{c}$.

8. Solve the equations $110x^2 - 21x + 1 = 0$ and $2\sqrt{3x+7} = 9 + \sqrt{2x-3}$.

9. Develop $(3a-2b)^5$ and find five terms of the expansion of $(a^3-x^3)^{-1}$.

10. Solve the equations

$$\sqrt{x^2+ax+b^2} + \sqrt{x^2+bx+a^2} = a+b \quad \text{and} \quad ax + 2\sqrt{a^2x+bx^2} = (3x-$$

11. Solve $\left(x - \frac{ab}{x}\right)^2 = \frac{a}{2}(a+b)\left(1 + \frac{a^2}{x^2}\right)$.

12. Find limits to the real values of x and y which can satisfy the equation $x^2 + 12xy + 4y^2 + 4x + 8y + 20 = 0$.

ALGEBRA.

CADET-ENGINEERS.

JUNE, 1881.—Time allowed, four hours.

1. Deduce formulas by which we may find the n th term and the sum of n terms of the series $a+b+c+d+$, &c. Apply the method to find the number of stones in a pyramidal pile with triangular base, side m .

2. Find the sum of the series $1^2+2^2+3^2+\dots+n^2$ by means of indeterminates. Find the sum of the series $\frac{1}{1.5} + \frac{1}{2.6} + \frac{1}{3.7} + \&c.$, ad infinitum.

3. Express 3.1416 as a continued fraction and find four convergents—find how much the last convergent differs from 3.1416. Express $2+\sqrt{3}$ as a periodic continued fraction, and find the value of the periodic fraction $3+\frac{1}{1+\frac{1}{2+\frac{1}{3+\frac{1}{4+\frac{1}{1+\&c}}}}$

4. Define a logarithm. Prove that $\log_a b \log_b a = 1$. What is the modular system of logarithms? Find the modulus of a system whose base is 7. Find the value of the expression, $\left\{ \begin{matrix} a^3. b^2. c. d^{\frac{1}{2}} \\ e. f^3. g^2 \end{matrix} \right\}^{\frac{1}{4}}$, given $a, 37.715$; $b, .0066182$; $c, .000098123$; $e, 24.876$; $f, 157.12$; $g, 1.4142$.

5. Find the values of x and y from the equations $y^2=az^2+cx$ and $y=mx+z$, noting these values by x_1, x_2, y_1 and y_2 , show that $(x_1+x_2) = \frac{c-2bm}{m^2-a}$ and $\frac{mc-2ab}{m^2-a}$. Let $h=\frac{1}{2}(x_1+x_2)$ and $k=\frac{1}{2}(y_1+y_2)$; then show (by elimination) $2ah-2mk+c=0$.

6. Show that the expression $(x^2+y^2+z^2+c^2-a^2)^2-4c^2(x^2+y^2)$ can be separated into two quadratic factors (1) if $z=0$, (2) if $x=0$, (3) if $z=\frac{ax}{\sqrt{c^2-a^2}}$, and find the value of each case.

7. Find the value of x^p , when $x=.0062845$, $y=.00038132$. Find the value of p where $P=x^Q$, $Q=x^R$, $R=x^S$ and so on ad infinitum, given $x=.1$.

GEOMETRY.

CADET-MIDSHIPMEN.

JUNE, 1881.—*Time allowed, four hours.*

1. Prove that in any polygon the exterior angles made by producing each of the sides in succession are together equal to four right angles. Prove that the three perpendiculars let fall from the vertices of a triangle upon the opposite sides meet in a point.

2. Show how to inscribe a circle in a given triangle (give the proof). Upon a given straight line describe a segment which shall contain a given angle. Construct a triangle, given two sides and an angle opposite one of them; discuss the cases that may occur.

3. Prove, geometrically, that the square described upon the hypotenuse of a right angle is equivalent to the sum of the squares described upon the other sides. Would this proposition be true if for square we substituted equilateral triangle, or circle described upon the side as diameter? Give reasons for your answer.

4. Prove that if, from a point without a circle, a secant and a tangent be drawn, the tangent is a mean proportional between the whole secant and the part without the circle. Construct a mean proportional between two given lines; divide a given line in extreme and mean ratio. Give reasons for the construction in each case.

5. Prove that a triangular pyramid is one-third of the prism of the same base and altitude. Deduce the formula for the volume of the frustum of a triangular pyramid.

6. Deduce the formula for the area of a plane triangle in terms of the sides, and find a similar expression for the radius of the inscribed circle.

Find the length of a side and the area of each of the following regular polygons inscribed in a circle, radius a ; square, equilateral triangle, hexagon, octagon, decagon, dodecagon.

A rectangular parallelepiped has a square base, side a ; on three consecutive edges of lengths b , c , d , respectively, are laid off (measuring from the base), and a plane is passed through the three points so determined. Find the distance from the base at which the plane cuts the other edge, and the volume of the truncated prism.

DESCRIPTIVE GEOMETRY.

CADET-ENGINEERS.

JUNE, 1881.—*Time allowed, four hours.*

Give full explanations of all constructions.

1. Determine the projections of a line which shall contain a given point, and make given angles α and β with the planes of projection. Find the traces of a plane which contains a given point and is inclined at angles α and β to H and V .

2. Given the three faces of a trihedral angle, find the three dihedral angles. Given two faces of a trihedral angle and a dihedral angle opposite one of them, find the third angle and the other dihedral angles.

3. Find the traces of a plane which contains a given line and is inclined at a given angle to H . Find the traces of a plane which contains a given line and makes a given angle with a given plane.

4. Through a given line draw a tangent plane to a sphere. Find the vertex of a cone which shall envelop two given spheres.

5. Find the projections and true form of a right section of an oblique cylinder, base circular, radius $1''.5$, elements oblique to H and V .

6. A sphere $2''$ in diameter has its centre $3''$ above H , the axis of a cylinder enveloping the sphere is inclined 45° to H . Find the projections of the line of contact, and the horizontal trace of the cylinder.

7. A cylinder stands on H ; the base is a circle, radius $1''.25$, centre $2''$ in front of V . Its elements are parallel to V and inclined 45° to H , and the altitude of the cylinder

is 4". A sphere, radius 2", has its centre at the middle point of that element of cylinder which is nearest to V . It is required to find the projections of the sphere as it appears after the portion common to the two surfaces has been removed. Draw a tangent to the curve of intersection.

CURVE TRACING (ELECTIVE).

JUNE, 1881.—Time allowed, four hours.

CADET-ENGINEERS—*C. M. Knepper, W. L. Capps, Milton Dargan, A. L. C. C. Baron, C. H. Hewes, R. O. Crisp, A. P. Biddle, F. K. Hill, H. E. Parmelee, W. O. Hulme.*

CADET-MIDSHIPMEN—*C. P. Plunkett, N. S. Moseley, A. N. Beecher, J. S. McIlwain, W. E. Cook.*

- Trace the locus of the equation $4y^2 - 4xy + 2x^2 + 4y - 10x - 12 = 0$.
- Trace the loci of the equations,
 $3y^2 - 4xy + x^2 - 12y + 4x + 9 = 0$ and $xy + 3x - 6y = 0$.
- Trace the loci of the equations $x^2 - 4y = 6x - y^2$ and $(2y - x + 2)^2 = 6 - x$.
- Sketch the loci of the equations $y = x^2$, $x^2 = -y^2$, and $y^2 = x^2$, and trace the loci of $x^3 - y^3 - x^2 + 2y^2 = 0$.
- Given the equation $(y - x)(y + x)(y + 3x) = 8xy$, find the asymptotes, the points where the curve crosses them, and trace the locus.
- Prove that the expression $\frac{ax^2 + bx + c}{cx^2 + bx + a}$ is capable of all values whatever $(a + c)^2$; that there will be two values between which it cannot lie if $b^2 < (a + c)^2 - 4ac$; and two values between which it must lie if $b^2 < 4ac$.
- Draw the locus of $y = \frac{ax^2 + bx + c}{cx^2 + bx + a}$ to illustrate the three cases of the previous question.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, LAW.

HISTORY.

MONTHLY EXAMINATION.

DECEMBER, 1880.—Time allowed, two hours.

- Give some account of (1) Simon of Montfort, (2) William the Silent, (3) of Navarre, (4) Maximilian I.
- Give an account of the German Reformation, 1517-1555.
- 1453 and 1492. Connect these two dates, pointing out the relation between the two events, and giving, in your own words, your opinion of the significance of the events in European history.
- (1) Peace of Bretigny; (2) Treaty of Troyes. Give the date of each, the important battles (with dates) in the war preceding each treaty, and state and the provisions of each.
- State briefly, in chronological order, the leading points in the wars of Louis XIV.
- (1) Dates, causes, sides, and leaders in the Thirty Years' War. (2) Give the name of the treaty that closed the war, and state the provisions of this treaty as to (a) the Netherlands, (b) Switzerland, (c) the United Provinces, (d) France, (e) Sweden.
- (1) Show by a genealogical table how Charles V obtained the different parts of his dominions, and (2) draw a map of the same, putting down the boundaries of the principal divisions, and the position of—

- | | | | |
|--------------|--------------|---------------------|-----------------|
| 1. Milan. | 6. Ratisbon. | 11. Strassburg. | 16. Bologna. |
| 2. Augsburg. | 7. Utrecht. | 12. Po River. | 17. Danube. |
| 3. Pisa. | 8. Sempach. | 13. Marignano. | 18. Elbe River. |
| 4. Trent. | 9. Lützen. | 14. Rhine River. | |
| 5. Ravenna. | 10. Pavia. | 15. Speyer (Spire). | |

ENGLISH AND HISTORY.

JANUARY, 1881.—*Time allowed, four hours.*

N. B.—Starred questions are alternatives.

A.—HISTORY.

I. Explain the origin and meaning of the following terms: 1. Arian. 2. Aryan. 3. Languedoc. 4. Emperor. 5. Feudal tenures. 6. Protestant. 7. Romance languages. 8. Pragmatic sanction.—*Take five.*

II. 1. "At the moment that Greece began to lose her political freedom she made an intellectual conquest of a large part of the world." Tell what this means, and show how the two changes were brought about. 2. Explain the nature and foundation of political freedom in Greece. 3. Where was Mantinea, and why is it celebrated in Greek history?

II.* 1. Show that the later Roman republic was nominally a democracy, but with aristocratic tendencies. 2. What was the nature of the changes made by Augustus in the government of the Roman state?

III. What nation made the first conquest of what is now known as England? the second? the third? the fourth and last? Describe the influence upon the country of each of these conquests, giving dates.

IV. 1. State what important facts in English history are indicated by the following groups of dates, and explain briefly the importance of the facts: 1215, 1265; 1603, 17, 1782, 1801; 1649, 1660. 2. "The Scots gained their liberty, and the establishment of their religion, by the same revolution that enslaved Ireland." Explain fully.

V.* During the XVI. century there was a long rivalry between France and Spain, which was in some sort a continuation of the dispute between the houses of Bourbon and Aragon for the kingdom of Sicily, as that had been a continuation of the earlier dispute between the Guelfs and Ghibelins." Explain fully all the allusions, showing the connection between the parties to the different controversies.

VI. "A new German power came to the front in Germany and it has gradually grown to be the head of Germany, much in the same way as Wessex grew in England, Castile in Spain, and France in Gaul. But its rise did not, like the rise of Russia, bring a race and religion from the background to the front." Describe briefly the allusions referred to in the various allusions in the above passage, with a fuller statement of the peculiar features of the rise of Russia. Give dates in explaining the allusions.

VII.* "For the very reason that the French kings had once had much less power than either the emperors or the English kings, they came in the end to have more power than either of them." Explain fully, showing what effect the feudal system had upon popular assemblies in the different states of Europe.

VIII. Draw a map of Europe west of the meridian of Vienna, after the peace of Westphalia, marking the boundaries of France, Spain, Portugal, Savoy, Naples, Switzerland, United Provinces, Palatinate, and the following places: 1. Aachen. 3. Gibraltar. 5. Dunkirk. 4. Bern. 5. Nimwegen. 6. Besançon. 7. Avignon. 8. Strassburg. 9. Genoa. 10. Utrecht. 11. Nantes. 12. Basel.

B.—ENGLISH.

IX. (1) Give the subdivisions of the family of languages to which English belongs, and name the members of the group most nearly related to it. (2) Name the foreign elements in English, in the order in which their influence was exerted. (3) Explain the terms: (a) Welsh; (b) Briton; (c) Norman conquest; (d) analytic and synthetic divisions of language.

XI. Analyze: I could never believe that Providence had sent a few men into the world, ready booted and spurred to ride, and millions ready saddled and bridled to be ridden.

IX.

She walks the *waters like a thing of life*
And seems to *dare* the elements to strife:
Who would not *brave* the *battle fire*, the wreck,
To move the *monarch of the peopled deck*?

Explain syntactically the words in italics.

X. The *virtues of sovereigns* are such as *tend to the maintenance of peace* and to the *resistance of foreign enemies*.

Explain the etymology of the words in italics. Show that the spelling of *sovereign* and *foreign* is artificial.

HISTORY.

APRIL, 1881.—Time allowed, two hours.

1. Give a brief statement of the measures adopted at the beginning of Washington's administration: (1) to provide a revenue; (2) to strengthen the public credit.

2. When and how did the Federalists lose control of the government? What circumstances connected with this event, and the political doctrines advocated by the different parties.

3. Give a brief account of any two of the following: 1. Embargo of 1807. Louisiana purchase. 3. British operations about the Chesapeake in 1814.

4. (a) Name the two Senators who took the leading part in the discussion of the rights in 1830, telling from what State each one came, and what doctrine advocated. (b) Who was the author of the Monroe doctrine, and when was it promulgated? Who was the British foreign secretary at the time, and who was the American minister at London? What was the position of the United States toward the revolting Spanish colonies at this time?

5. What was the geographical line fixed by the Missouri compromise? What territory was slavery prohibited by this compromise? What two States were admitted at this time? What was the question that arose in the Constitutional convention regard to considering slaves in the apportionment of representation, and how was it settled?

HISTORY.

MAY, 1881.—Time allowed, four hours.

1. Explain the Monroe doctrine; state when, by whom, and in what state it was first laid down, and show how far it influenced American politics.

2. What is a representative assembly? What was the first representative assembly in America? What was the general character of the assemblies in the colonies? Describe the government of Plymouth colony.

3. Four colonial wars: dates, causes, corresponding wars in Europe, treaties.

4. State briefly the political views or leanings of any six of the following: Washington, Hamilton, Jefferson, John Adams, Jay, Calhoun, Clay, J. Q. Adams, Jackson, Webster, Douglas.

5. Name the successive Presidents, with the date of the beginning of each administration. Refer the following to the administrations in which they occurred: Webster-Ashburton treaty. 2. Ostend manifesto. 3. Louisiana purchase. 4. Texas arbitration. 5. Treaty of Guadalupe Hidalgo.

6. Explain the points at issue in 1844, as to the annexation of Texas, and show how and with what results, the question was brought into the Presidential campaign that year.

7. Name the successive commanders of the Army of the Potomac from 1861 to 1865, and state the decisive events during the campaigns of each.

8. State in exact language the terms of the Missouri compromise. How have the boundaries or territories of the United States altered in 1803? in 1819-21? in

3? in 1867? State exactly the boundaries of each acquisition, and the which it was made.

was the Milan decree? Who composed the two missions sent to France by John Adams? Which mission succeeded, and which failed? What were legal powers assumed by Genet? Who succeeded Genet? On what condition Georgia cede her western lands?

an exact account of Greene's campaign in South Carolina during the Rev-

RHETORIC.

MONTHLY EXAMINATION.

FEBRUARY, 1881.—*Time allowed, two hours.*

plain fully the distinction between *shall* and *will*, giving original examples and explain fully the three elements or tests of good use in language. Distinguish between *falsity* and *falseness*; *continual* and *continuous*; *observation* and giving original examples.

the faults in the following passages, show why they are faults, and correct them. In correcting the sentences, make only such changes as are necessary to phrase to good English.

When you and I, I was lead to take this view by seeing some illy-disposed individuals whom I was acquainted with, who didn't feel as though they would be willing to be knocked the thing on the head. I reckoned that they was trying to introduce a new system, different than what we had been used to, and I expect I was right.

A city don't want that much ground given up for a park. It was quite a surprise finding that it should be found that it would need it for other purposes; and I am persons would of guessed it would be more preferable to have it, on account of public health. These sort of measures have been tried considerable before and the canaille antagonizes them.

Because I ain't much inclined to predicate anything about it. I don't know as it is possible to readily find a person anywheres which will ventilate the job and talk about it. I am as ready, indeed I am more so than my neighbors, who will only put on a superficial show of public spirit, but each of them, when it comes to the point, they demean themselves by having a decisive opinion, and in which they are wrong.

RHETORIC.

MONTHLY EXAMINATION.

MARCH, 1881.—*Time allowed, two hours.*

State the comparative advantages of general and specific terms, in reference to the force and style.

Describe and explain, with original illustrations, the various forms of figurative language.

Discuss the relative importance of clearness, precision, and force, under different circumstances, and in different kinds of composition.

Point out faults and explain corrections: The windings of the San Juan River make it doubtful whether it shall be built with money which it is claimed will be paid for it; the enormity of the work, and the climate, subject to extremities of drought, are arguments against it which will be destructive of the canal project; the obstructing of it commences.

Point out the faults: It must be the political policy of the United States to dispel the clouds of ignorance that has been brought over by tides of immi-

gration since she made her *début* in the galaxy of nations; and then the of American intelligence shall deepen into a profound ocean of intelligence, European knowledge, which will know no limits.

6. (Extra question). Explain the term *fallacies of confusion*. Show that meanings in a word may produce such fallacies, illustrating the states words *theory* and *money*, as discussed by Mill.

RHETORIC.

MONTHLY EXAMINATION.

APRIL, 1881.—*Time allowed, two hours.*

1. Explain what is meant by *movement* in narrative. Why is it said of writing, that "each is strongest at the other's weakest point"? What may be employed to give in writing suggestive descriptions of things, places, &c.

2. Give Blair's rules for unity.

3. Discuss loose and periodic sentences; short and long sentences; part and end of a sentence.

4. Explain the difference between a term and a proposition, and show which is a better subject for composition than the other.

5. Explain induction, deduction, *reductio ad absurdum*, giving illustrations. What do you understand by *logic*?

6. Explain circumlocution, its sources, and its advantages and disadvantages.

7. Explain antithesis; point out its advantages, and show the effect of excess. What can you say of balanced sentences?

8. Discuss the theories of Bentham and Herbert Spencer in regard to the use of words.

RHETORIC.

MAY, 1881.—*Time allowed, four hours.*

1. Name and define the three classes of offenses against correctness of style. Under the three divisions under the head of each class, explain them, and give an example of each.

1.* What do you mean by saying that a writer has a "large vocabulary"? Can you say of Shakspeare in this respect? of Milton? What are the advantages of a copious vocabulary? What is the best way to secure it? Name and explain three principal qualities to be sought after in the choice of words.

2. What is meant by saying that *movement* and *method* are "the life and the order of discourse"? What are the peculiar advantages of *method*? "A writer who reaches the imagination or the feelings by means peculiar to his art." Explain three ways in which this may be successfully done, in narrative or description. Give the advantages of each.

2.* Explain *burden of proof*, *presumption*, *presumption of law*, *counter-presumption*. What is meant by saying that a presumption is "an avowedly imperfect foundation"? State fully the advantage, in argument, of having the presumption on your side, and give illustrations of common presumptions.

3. Explain analogy, arguments from analogy. Show how to test the force of an argument from analogy. Show how a false analogy may be made the basis of an argument, and illustrate from the use of the phrase "paternal government."

4. Explain syllogism, argument from antecedent probability, begging the question, Point out the necessity of expert testimony, and its dangers.

5. What are *tropes*? What quality of style is secured by their use? Why? Explain the relation between metaphor and simile. "Personification is dangerous in English." Why is it easy, and why is it dangerous?

5.* Distinguish between womanly and womanish; purpose and proposal; *style*

justice; statesman and politician. Explain briefly and illustrate the correct and the correct use of *quite, transpire, inaugurate, confess.*

Point out and name the faults in the following, correct them, and explain the corrections:

Between you and I, I expect the Colonel had such firmness and resolution, which could most always have carried him through considerable of a difficulty; but an individual wants more than firmness when he is engaged in these kind of things. In short, needs a different character than that of the Colonel; and though he tried most incessantly to correct himself, it seems like he was unable to change his nature. He was from a man of exceptionable will.

The enfeebled animal stumbled, and the occupant of the team was thrown down, precipitated to the pavement. Immediately he touched the stony surface some times, standing around, and who commenced to politely offer their services, found had broke his leg, together with some bruises; and so, after he had raised up, he down on a bench for a spell. After that, he thought he could walk as well as me or me.

The red, white, and blue pennants are carried by flag-officers, in the different sides of command, but neither merchantmen or fishing-smacks carry them.

Making a virtue of necessity, the question will be brought to a vote on Tuesday. I think I will be present; I want to see who it is opposed by. You shall probably according to your inclinations.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

JUNE, 1861.—*Time allowed, three hours.*

Translate into French:

ANNAPOLIS, June 2, 1861.

DEAR FRIEND:

I owe you a letter, and I am going to write it in French.

I have been now one year at the Naval Academy.

It has been a continual labor, a continual occupation.

Here, one must work hard to succeed.

There are from two to three hundred cadets at the school.

There are also a great many officers; they are our instructors.

They live with their wives and children in fine brick houses covered with slate.

On Saturdays we have permission to go out in town.

Annapolis is not the most populous or the most commercial city in America;

it is a pretty little town.

There is a railroad from here to Baltimore and Washington; there are also one or two lines of steamboats.

We often watch them as they sail away on the beautiful Chesapeake Bay.

It has been a very cold winter, and the snow remained on the ground for more than two months.

Nevertheless, we have had many amusements, and I have danced a great deal of balls and hops.

I am stronger than I used to be, and I have grown since you saw me.

Our fare is wholesome, and plentiful, and if our appetites are not good, it is not want of exercise.

We leave in a fortnight to go on a cruise for the summer, and I shall not see you before next September.

Adieu! or rather au revoir!

Your devoted friend,

L'ARTISAN ET LE MATELOT.

Un artisan demanda une fois à un matelot où était mort son père. Celui-ci que son père, son grand-père et son bisaïeul étaient tous morts en mer.

"Eh bien!" dit l'autre, "n'avez-vous donc point peur d'aller en mer?"

"Pas le moins du monde," répondit le matelot. "Mais à votre tour dit vous prie, où sont morts votre père, votre grand-père et votre bisaïeul?"

"Ils sont morts dans leurs lits," dit l'autre.

"À merveille," reprit le matelot, "mais alors pourquoi aurais-je plus peur sur mer, que vous d'aller vous coucher?"

GRAMMAR.

1. How many genders are there in French? Name them.
2. How is the gender of nouns denoting living things determined?
3. Is there more than one article?
4. When is the article to be repeated?
5. Give the personal pronouns used as subjects.
6. Where are they placed in interrogative sentences?
7. What is the place of 'ne—pas'?
8. Give the possessive adjectives, with their masculine, feminine, and plural.
9. As a general rule, how is the plural of nouns formed?
10. How do you form the plural of nouns ending in *au*, *eu*, and *ai*?
11. A sentence being interrogative and the subject a noun, how is the sentence construed?
12. How many kinds of limiting adjectives are there? Name them.
13. With what do the possessive adjectives agree?
14. When is the form of the demonstrative adjective *ce* used, and when *cet*?
15. How many classes of verbs are there in French?
16. How many participles are there in French? What are the endings of the participle for all verbs?
17. When is the form *est-ce que* obligatory?
18. How is the object of a transitive verb called?
19. Give in a table—
 - (a) The second person, singular and plural, of the indicative.
 - (b) The third person, singular and plural, of the imperfect.
 - (c) The first person, singular and plural, of the future.
 - (d) The second person, singular and plural, of the present of the subjunctive of *avoir*, *être*, *couper*, *aller*, and *envoyer*.

SPANISH (ELECTIVE).

JUNE, 1881.—Time allowed, four hours.

Cadet-Engineers A. P. Biddle, W. L. Capps, and L. A. Wedderburn.

Translate into French:

ACCION HEROICA.

Un capitán holandés, llamado Schaeffelar, defendía con su gente la fortaleza de Barneveldt. El enemigo sitió la plaza, y exigió su rendición; pero Schaeffelar á capitular ántes de que la brecha se hubiese abierto. El primer artículo de la capitulación exigía que el comandante de los sitiados fuese precipitado por el alto del torreón. Esta bárbara condición los indignó, y juraron ántes morir á semejante exigencia. Pero el generoso Schaeffelar, al oír tan noble resolución, consideró el peligro á que ella los exponía, subió rápidamente á lo mas alto del torreón, y les dijo: "Amigos míos, es preciso que yo muera un día, y jamás se repeta otra ocasión como esta para morir gloriosamente, ya que mi muerte salva

arades." Dijo, y en presencia de sus soldados atónitos, se precipitó de lo alto con.

late into Spanish :

HÉROÏSME.

ar que le roi Charles XII, assiégé dans Stralsund, dictait des lettres pour la un secrétaire, une bombe tomba sur la maison, perça le toit, et vint éclater la chambre même du roi. Au bruit de la bombe et au fracas de la maison qui tomber, la plume échappa des mains du secrétaire: "Qu'y a-t-il donc?" lui dit un air tranquille, "pourquoi n'écrivez-vous pas?" Celui-ci ne put répondre mots: "Eh, sire, la bombe!" "Eh bien," reprit le roi, "qu'a de commun la avec la lettre que je vous dicte? Continuez."

THIRD CLASS.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.

CADET-MIDSHIPMEN.

JUNE, 1881.—*Time allowed, four hours.*

ne the different kinds of blocks in common use on board ship, and state the ce between a mall block and a morticed block.

scribe in general terms a tackle and its uses. Give a particular description lain the use of the luff tackle, burton, garnet and relieving tackles.

scribe a patent dead-eye, and explain the method of setting up rigging when d-eye is used.

ake a drawing of a topsail-yard showing all its parts and rigging complete.

ke up a course for bending, and bend it.

scribe the different methods of marking chain cables, and state how they are n board and stowed.

DEPARTMENT OF MATHEMATICS.

TRIGONOMETRY.

JANUARY, 1881.—*Time allowed, four and a half hours.*

nd the circular measure of $\tan^{-1}\sqrt{2}$. Find the degrees, minutes, and seconds re whose circular measure is π^c . Take from the tables the logarithms of the g functions: $\cotan 89^\circ 37' 45''$, $\sec 88^\circ 30' 30''$, $\operatorname{cosec} 165^\circ 30' 30''$, $\sin 203^\circ 5' 18''$ n $269^\circ 44' 48''$. Find the log ver sin of $187^\circ 15'$.

luce the formulas necessary to solve a right triangle when one side is very qual to the hypotenuse. Find the distance at which a light can be seen, the f the light above the sea level being 169 feet. (Earth's radius 4,000 statute Give answer (1) in statute miles, (2) in geographical miles.

a plane triangle given A , $69^\circ 30' 30''$; b , 373.65; c , 281.42; solve the triangle its area. Deduce the necessary formulas.

en t , $31^\circ 13'$; d , $15^\circ 12' S$.; h , $57^\circ 11'$; find L and Z . Given A , $31^\circ 13'$; b , ; a , $32^\circ 49'$; find c and B .

en t , $40^\circ 10'$; d , $18^\circ 20' N$.; L , $40^\circ 35' N$.; find h and Z . Given A , $40^\circ 10'$; b , c , $49^\circ 25'$; find a and B .

en A , $139^\circ 38' 45''$; B , $42^\circ 33' 30''$; c , $129^\circ 21' 15''$; solve the triangle.

e height of a ship's mast is 169 feet and the length of the top-gallant mast is 50 e angle between the truck and the water-line is measured from a boat and o be $10^\circ 30'$. Find (1) the distance of the ship in statute miles; (2) the angle ed by the top-gallant mast; the last result to be correct to tenths of seconds.

8. Find x from the equation $\cot^{-1}x + \cot^{-1}(n^2 - x + 1) = \cot^{-1}(n - 1)$ and prove $\cos^2\theta + \cos^2(a + \theta) - 2 \cos a \cos \theta \cos(a + \theta)$ is not a function of θ .

9. Prove that the value of $\frac{\tan(x+a)}{\tan(x-a)}$ lies between $\frac{1+\sin 2a}{1-\sin 2a}$ and $\frac{1-\sin 2a}{1+\sin 2a}$ for all possible values of x ; and solve the equation $\sin 2x + \cos 2x + \sin x - \cos x = 0$.

10. A quadrilateral is inscribed in a circle, radius 10: three of its sides are 2, 4, 11; find the fourth side and the angles and area of the quadrilateral.

ANALYTICAL GEOMETRY.

CADET-ENGINEERS.

MONTHLY EXAMINATION.

APRIL, 1881.—Time allowed, two hours.

1. Given the general equation $ax^2 + bxy + cy^2 + dx + ey + f = 0$, in which $b^2 - 4ac \neq 0$: find (h, k) , the co-ordinates of the centre, and find what the equation becomes when the origin is moved to (h, k) . Show how the equation is finally reduced to $Ax^2 + By^2 + F = 0$, and find A and B in terms of a, b , and c .

2. Show that, however the axes may be situated, $b^2 - 4ac = b'^2 - 4a'c'$, $a + c = a' + c'$. Show how the reduction of the general equation is effected, $b^2 = 4ac$. Reduce $(y - x)^2 + 4x + 3y = 0$ to the form $y^2 = Px$.

3. State what is represented by each of the following equations (give the reasons for the statement in each case): (a.) $y^2 - 4ax = 4ay - x^2$,

(b.) $x^2 - 2xy + y^2 + 5ax - 5ay + 6a^2 = 0$, (c.) $(x - y)^2 + 5a(x + y) = 0$,

(d.) $y^2 - 2xy + x^2 + 5ax - 5ay + \frac{25a^2}{4} = 0$; (e.) $xy + 4ax + 5ay + 6a^2 = 0$,

(f.) $(x - 3y)(x - \frac{1}{2}y) = 3ax$, (g.) $2x^2 + xy - y^2 - 5x + 7y - 12 = 0$,

(h.) $3x^2 + 2xy + 3y^2 + 8ax + 8ay + 10a^2 = 0$.

4. Reduce the following equations to the form $Ax^2 + By^2 + F = 0$:

(a.) $5x^2 + 3xy + y^2 + 4x - y - 9 = 0$; (b.) $5y^2 + 12xy + 36x + 6y - 39 = 0$. Trace the locus of the latter as it stands.

5. Find the equations to the tangent and normal to $ax^2 + bxy + cy^2 + dx + ey + f = 0$. Trace the loci of the equations $4x^2 + y^2 - 4xy - 24x + 22y + 61 = 0$ and $2y^2 - 2xy + x^2 - 4x + 16y + 32 = 0$.

6. Find the equation to a plane whose traces are $z = m(x - h)$, $y = n(x - h)$ if a parabola revolves about its directrix: find the equation to the surface generated, investigate the character of the section of the surface by a doubly tangent plane.

7. Find the equation to a ring, distance from the axis to the centre of generating circle, a , radius of generating circle, b . Find the equation to a plane perpendicular to F and doubly tangent to the ring internally. Show that the horizontal projection of the section consists of two ellipses, and that the true form of the section is a combination of two circles. Show also that if $a = 2b$, a plane perpendicular to H and F , and tangent to the ring internally, cuts it in a lemniscata.

ANALYTICAL GEOMETRY.

CADET-MIDSHIPMEN.

JUNE, 1881.—Time allowed, four hours.

1. Deduce the equation to the straight line (1) in terms of the intercepts a and b (2) in terms of a and p . Find the length of the perpendicular from (a, b) upon the line $\frac{x}{a} + \frac{y}{b} = 1$. Find the tangent of the angle between the two straight lines represented by the equation $Ax^2 + Bxy + Cy^2 = 0$.

2. Deduce the formulas of transformation by which the axes are turned through an angle ϕ , and find what ϕ must be in order that the transformation may cause the

y to disappear from the equation $ax^2 + bxy + cy^2 + dx + ey + f = 0$. Find the equations tangents to $x^2 + y^2 - 2x + 12y + 5 = 0$ which pass through the point (5, 6).

Define the Ellipse and deduce its central rectangular equation. (Give the work all.) Find the polar equation to the ellipse by moving the origin to the left-hand axis: determine two values of r . Define Asymptotes; find the asymptotes to $-5xy - 12y^2 + 26y = 0$, and to $x^2 - 3xy + 6x + 8 = 0$.

Trace the locus of each of the following equations: $x^2 - 8x = 4y - y^2$, $(y - 2x)^2 = 4x$, $xy - 2x^2 - y + 7x = 12$, and $2y^2 - 2xy + x^2 + 4y - 8x + 12 = 0$. Find what the last equation becomes: (1) when the origin is moved to the centre; (2) when the locus is referred to centre and axis.

Given the co-ordinates of four points: $A, (a, o)$; $B, (o, b)$; $C, (-b, o)$; $D, (o, a)$. Find the equations to AB and CD ; (2) find the co-ordinates of the point of intersection, P , of the two lines; (3) find the equation to the locus of P , when $a + b = 2c$, and trace the curve.

The parabola $(y - mx)^2 = Px + Qy$ passes through the points $(2a, o)$ and $(o, 2b)$: find values of P and Q and the equations to tangents parallel to the axis. Find the point of intersection of these tangents when m varies, and trace the curve.

DESCRIPTIVE GEOMETRY.

CADET-ENGINEERS.

JUNE, 1881.—Time allowed, four hours.

A right circular cylinder lies on H ; radius of base, $1''\cdot25$; axis inclined 30° to V ; top $4''$. Required to draw the perspective of the bases of the cylinder, with the top on H ; point of sight, $(5\cdot25, -5, 4)$.

A right circular cone stands on an inclined plane, its base touching H and V . Plane is perpendicular to V and inclined 45° to H , the radius of the base is $2''$ the altitude $4''$. Draw the figure in perspective, point of sight $(6\cdot5, -6, 5)$.

A cone and a plane are given as in the preceding question, except that the base of the cone is an ellipse which is horizontally projected into a circle of $2''$ radius. Draw the perspective of the portion of the cone included between its base and a section plane perpendicular to V , inclined 30° to H and passing through $(8\cdot5, 0, 0)$. Give a brief statement of the method used in finding the section.

An ellipsoid, semi-axes, $1''\cdot25$, $2''$, and $3''$ lies on H , and touches V ; major axis horizontal, minor axis vertical. Find the projections and true form of the section by a plane whose horizontal and vertical traces are inclined 60° and 30° to the ground-line. The vertical trace passing through the point where the ellipsoid touches V . Explain the method of finding the projections of the section.

DESCRIPTIVE GEOMETRY.

CADET-MIDSHIPMEN.

JUNE, 1881.—Time allowed, four hours.

Find where a given line pierces an oblique plane given by its traces. Draw two parallel lines and find where a third line pierces the plane of these lines without finding the traces.

Draw two lines which intersect, and find the angle between them. Find the height of a perpendicular let fall from a given point upon a given oblique plane. Show how this perpendicular is found when the plane is parallel to the ground-line. Find the angle between two planes: (1) the general case; (2) when the vertical traces intersect while the horizontal traces are parallel; (3) when both planes are parallel to the ground-line.

Define stereographic projection. What is meant by a subcontrary section? Prove the subcontrary section of an oblique cone with a circular base is a circle. Prove the stereographic projection of any circle of the sphere is a subcontrary section of a certain cone.

5. What are the principal properties of the stereographic projection? Find, in terms of the polar distance and inclination of a circle, for the distance from the centre of the primitive to the extremities of a diameter of the projection a primitive circle of $1''.5$ radius, assume a point inside and one outside, and the great circle joining the two points.

6. Make the following projections of the astronomical triangle:

(a) Given d , 45° N.; h , 45° ; L , 25° N. *Plane of meridian.*

(b) Given p , 75° ; h , 30° ; t , 25° . *Plane of equator.*

(c) Given d , 45° N.; L , 30° N.; t , 60° E. *Plane of prime vertical.*

7. Given t , 45° W.; Z , 120° W.; project the triangle on the plane of the horizon. Find the true form of the section and construct the asymptotes. Explain the methods used last two cases.

8. Draw a right circular cone showing both nappes, and cut it by a plane so that the section may be a hyperbola. Find the true form of the section and construct the asymptotes.

9. Find the horizontal projection of the intersection of a cylinder and sphere. The base of the cylinder is a circle, radius $1''.25$, centre at $(1.5, 1.5, 0)$; the element parallel to V and inclined 60° to H —the centre of the sphere is at $(3.5, 2, 2)$ and the radius $1''.5$. Make the drawing as though the cylinder were removed. Explain how a tangent to the curve may be drawn.

INTEGRAL CALCULUS.

ELECTIVE COURSE.

JUNE, 1881.—Time allowed, four hours.

Cadet-Midshipmen G. W. Street, S. D. Greene, W. E. Bowman, C. E. J. B. Jackson, and M. E. Lennon.

Cadet-Engineers W. J. Baxter, S. W. Armistead, C. P. Eaton, W. S. G. W. Dyson, J. M. Ellicott, G. F. Zinnell, G. W. Littlehales, and C. J. Green.

Find the integrals of the following expressions:

$$1. \cos^2 \theta d\theta, \sin^2 \theta d\theta, \frac{d\theta}{\sin \theta}, \frac{d\theta}{\cos \theta}, \text{ and } \frac{dx}{\sqrt{x^2 \pm a^2}}.$$

$$2. \frac{dx}{\sqrt{2ax - x^2}}, \sqrt{a^2 - x^2}.dx, \sqrt{x^2 + a^2}.dx.$$

$$3. \frac{d\theta}{a + b \cos \theta}, [(1) a > b (2) a < b], \frac{dx}{(1+x^2) \sqrt{1-x^2}}.$$

$$4. \frac{x^2 dx}{1+x^2}, \frac{(x^2+x+1) dx}{(x-1)^2 (x+2) (x^2+2x+3)}.$$

$$5. \frac{(x^2-1) dx}{x \sqrt{1+3x^2+x^4}}, \frac{(ax+b) dx}{x^2+cx+d}.$$

6. Find the whole area of the curve, $(x^2+y^2)^2 = 4a^2x^2 + 4b^2y^2$.

7. Trace the locus of the equation $x^{2m+1} - a(2m+1)x^{2m} + y^{2m+1} = 0$, that it differs in form according as m is odd or even. Prove that the area of the loop is $(2m+1) \frac{a^2}{2}$, and that the area included between the infinite branches and the loop is equal to the area of the loop.

8. A solid is formed as follows: the base is a square $ABCD$, side a ; at A , E , F , G perpendiculars are erected to the plane of the base, $AE = b$, $BF = c$, $CG = d$. Planes through these perpendiculars and the sides of the square form the top face of the solid, and the top is a surface generated by a right line which moves along the lines EF and HG , remaining constantly parallel to the plane $EADH$. Find the volume of the solid contained between this surface and the five planes.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELEMENTARY PHYSICS.

CADET-MIDSHIPMEN.

MAY, 1881.—*Time allowed, four hours.*

[Ten questions required.]

force, mass, velocity, stable and unstable equilibrium, energy, momentum, specific gravity, mean coefficient of expansion, specific heat and latent heat.

Explain geometrically the action of the wind on the sails of a ship, and explain how vessels can sail in opposite directions with the same wind. 50 kilogrammes support which is allowed by machinery to acquire a velocity of 2.5^m per second at is the pressure on the support?

Water passes from the sea into a river, and after discharging 44,800 pounds of steam is found to sink to the same mark as in the sea. Required the weight of 1 cc. Sp. gr. of sea water, 1.026.

A stone is dropped from a cliff and five seconds after it is heard to strike the water. Temperature of the air being 24° C., required the height of the cliff.

Describe the nature of sound waves, and upon what does the velocity of sound in air

depend? It measures 5.7 in C. G. S. units; what will it measure in statical units? Density of steam at 110° C. is 640; what is the corresponding temperature and density of steam Fahr.?

Describe capillary phenomena, spheroidal state, mirage, the flash and noise of lightning, electricity, the telephone.

Describe dispersion of light, interference of light, the Galilean telescope, the microscope, and the action of a concave mirror and a double convex lens.

How does the pressure of a gas vary with its volume. Illustrate the theory of Boyle's law. Pressure of a gas is proportional to its density. Explain the principle of the aneroid.

What will be the result of mixing five kilogrammes of ice at 0°, one kilogramme of water at 60°, and one-half a kilogramme of steam at 100°?

What is the refracting angle of a prism should be less than twice the critical angle? Also that the refracting angle and the angle of minimum deviation being known, the index of refraction may be obtained.

The index of refraction of alcohol is 1.374, of flint glass 1.575. What is the deviation of light which makes an angle of incidence of 20° with the normal? Describe the action of a flint-glass prism immersed in alcohol, the refracting angle being

known. Describe the action of the electrophorus. What is a solenoid? According to Ampère's theory in magnets, how do the currents flow in each pole?

ELEMENTARY PHYSICS.

CADET-ENGINEERS.

MAY, 1881.—*Time allowed, four hours.*

Describe mass, weight, force, work, horse-power. How long must a force of 150 lbs. act on a mass of 2,500 kilogrammes to impress upon it a velocity of 5 ft. per second? What must be the magnitude of the force which would bring a body to rest in one second?

Find the time of oscillation of a pendulum whose length is 0.99384^m in a place where the intensity of gravity is 9.81? Find the intensity of gravity at a place where the length of the second's pendulum is 0.991^m.

Describe and distinguish between density and specific gravity. A man (sp. gr. 1.12) weighs 150 kilogrammes. Required the volume of cork (sp. gr. 0.24) that will just float

4. In the cases of a boat partially and of a body entirely immersed, explain the positions of the centres of gravity and buoyancy for a condition of equilibrium. metacentre, and also the principle upon which the use of ballast depends.

5. A ship sailing into a river sinks 2^{cm}, and after discharging 12,000 kilograms her cargo rises 1^{cm}; determine the weight of the ship and cargo, the sp. of water being 1.026.

6. What are the formulas for velocity of efflux of a liquid and for quantity discharged through an orifice? From an orifice water spouts with a velocity of 10 metres; what is the head? In a cylinder water stands 2 metres above the orifice and is loaded with a piston which presses with a force of 3 kilogrammes on the piston; required the velocity of efflux.

7. Define sound. How is the velocity of sound affected by the temperature? winter the report of a gun is heard 15 seconds after the flash is seen; required the distance, the temperature of the air being 10° C.

8. Define critical angle and index of refraction and express their relation. What is the altitude of a celestial object affected by refraction? Describe fully the method of determining the altitude of a celestial object.

9. An equiangular flint-glass prism is immersed in alcohol. What is the deviation (in the prism) of a ray of light that on striking the prism makes an angle of 30° with the normal. Index of refraction of flint glass, 1.59; index of refraction of alcohol, 1.372.

10. Explain by drawings the images formed in the opera-glass, compound microscope, terrestrial telescope, and celestial telescope. State fully the position of the eyepiece and objective lenses in a telescope.

11. What is the cause of chromatic aberration in optical instruments, and how may the eye-piece of a telescope be arranged to counteract to some extent the chromatic aberration of the object-glass? What is the arrangement in the best opera-glass?

[Ten questions required.]

DEPARTMENT OF ENGLISH STUDIES, HISTORY, LAW.

CONSTITUTION OF THE UNITED STATES.

MONTHLY EXAMINATION.

DECEMBER, 1880.—*Time allowed, two hours.*

1. Explain the expressions *writ of habeas corpus*; give the constitutional reference to its suspension, and discuss the question as to who has the authority to suspend the writ, giving precedents.

2. State the powers exercised by different branches of the government over the militia, and name the occasions, with dates, upon which the militia has been called out.

3. Give a brief administrative history of the Navy, stating the principal acts, dates, relating thereto.

4. What is a bill? an act? a letter of marque? piracy? a bill of credit? a direct tax?

5. Explain the system of national banks.

6. Give the qualifications of Senators; of Representatives.

7. What session of what Congress began yesterday? How long does a Congress last? Between what dates is it in existence? Explain the difference between the beginning of a Congress and the beginning of a session. What is a quorum of the House? What limitations are placed on the power of either House to adjourn?

CONSTITUTION OF THE UNITED STATES.

MONTHLY EXAMINATION.

JANUARY, 1881.—*Time allowed, two hours.*

1. State (in full) the mode of election of the President and Vice-President.
2. State the two ways in which amendments to the Constitution may be proposed and ratified. What can you say as to the power of the President to veto an amendment; as to the withdrawal by a State of its ratification?
3. Explain *reprieve, amnesty, executive session, prorogation, and dissolution.*
4. Describe the various courts composing the judiciary system of the United States.
5. State the classes of cases in which the Supreme Court has (1) original jurisdiction, (2) appellate jurisdiction. Explain the reason for the XI. amendment and its effect.
6. (1) Explain the formation of the State of West Virginia. (2) Describe the position of Missouri during the rebellion. (3) Explain the method by which the States in rebellion were restored to their former position, and name the State which was the last restored.

CONSTITUTION OF THE UNITED STATES.

JANUARY, 1881.—*Time allowed, four hours.*

- I. With whom rests the power to impeach? to try impeachments? to suspend public officers in recess? to expel members of Congress? to remove disabilities from persons formerly in rebellion? to originate revenue bills? to call for yeas and nays? to regulate the time, place, and manner of holding elections of Senators? to make treaties? to appoint Senators? to fill vacancies in recess of Legislature?
- II. State the provisions of the Constitution in regard to the power of Congress to lay taxes in general; to lay direct taxes; to lay duties on exports. What is provided to duties levied by the States? Explain fully all the kinds of taxes referred to these clauses. What is a tariff? excise?
- III. Give the constitutional clause relating to the census. How are Representatives appointed? What is the constitutional limit in reference to apportionment? What was the ratio of population first adopted? What is the present ratio? Describe the process of electing Senators.
- IV. State the powers of Congress in regard to the Army and Navy; in regard to the militia; in regard to the prosecution of war. What is the tenure of office in the Army and Navy? Give the constitutional clause in regard to the guaranty and protection of State governments. What is the extent of the power of Congress over places ceded to the general government? What reservation is generally made in these cessions?
- V. Show why a State legislature cannot revoke its own grants. How are municipal charters regarded in this connection? What was the Dartmouth College case, and what bearing does it have on this subject?
- VI. What are legal tenders? What decisions have been made by the Supreme Court in regard to making Treasury notes legal tenders? Under what provisions of the Constitution were the issues made, and what is their true character? Explain the refunding act of July, 1870.
- VII. Enumerate: (1) the absolute prohibitions on the States; (2) those subject to regulation by Congress. What are inspection laws? Tonnage duties.
- VIII. Define treason. What is necessary to the conviction of treason? What is the punishment of treason? What is constructive treason? What is corruption of blood, and how does it work? What is a bill of attainder? a bill of pains and penalties? What is the reason for the constitutional prohibition in regard to bills of attainder?

RHETORIC.

MONTHLY EXAMINATION.

FEBRUARY, 1881.—*Time allowed, two hours.*

I. (1) Name the three conditions that must be fulfilled in order that descriptions may attain strength or sublimity. (2) Explain any one of these conditions, and show its application.

II. Give the four main rules to secure clearness, with an original example of each.

III. "A series of abstract terms is difficult to follow." (1) What are abstract terms? What is the opposite of an abstract term? (2) Show the correctness of the quoted statement, and give the modifications to which it is subject.

IV. (1) Name and distinguish the three principal violations of brevity, giving original examples of each. (2) Name the three sources of brevity.

V. Show when the coupling of synonymous words and phrases is admissible.

VI. (1) Explain fully *pathos*, *humor*, and *wit*. (2) What is meant by saying that the epigram is the purest representative of wit?

RHETORIC.

MONTHLY EXAMINATION.

APRIL, 1881.—*Time allowed, two hours.*

Omit any one of the seven questions you please; the answers to six only are required.

I. Explain the terms *rhetoric*, *scientific generalisation*, a *philosophical history*, *subject world* and *object world*, *unity*, *figure of speech*.

II. "All our intellectual powers are reducible to three simple modes of working." Name and explain each of these modes.

III. What is a *pointed style* of composition? Explain *loose sentence*, *period*, *balanced sentence*, and state the advantages of each form of expression. Explain *antithesis*, *verse iteration*, and *epigram*, and show how they may be combined with a balanced structure of sentences.

IV. Give the main rules governing the structure of the paragraph.

V. "A description is more easily and fully realized when made individual." Explain the statement, and give reasons for it.

VI. Explain the importance of (1) geography, (2) chronology, in the study of history.

VII. Discuss the principles: (1) "Qualifying words should precede the object that they qualify"; (2) "Expressions most nearly related in thought should be placed closest together." What general principles govern the position of the subject and the predicate?

NAVAL HISTORY.

MONTHLY EXAMINATION.

MAY, 1881.—*Time allowed, two hours.*

I. Give a tactical description of the battle near Point Drepanum, with diagrams: state the date, parties, and results.

II. Explain the terms *di-ekplous*, *corvus*, *carronade*, *Greek fire*, *the dolphin*.

III. Explain when the following were first used: (1) sheathing; (2) cannon in the action; (3) topsails; (4) chain shot; (5) mariner's compass. Give a brief history of last named.

Give an account of Blake's attack on Santa Cruz. Name the two similar attacks made by Blake at earlier periods of his career, and show how these attacks a stage of development in naval warfare.

Give a brief description of the causes of the first Dutch war. Give a full description of the battle that preceded the declaration of war.

Give a tactical description of the second battle of the Texel, with diagram, commanders, and results. Why does this battle mark a new era in the history of the sail?

Give a brief account of the following: (1) De Ruyter; (2) Duilius; (3) Themistocles; (4) Penn; (5) Prince Rupert; (6) Monk. *Take four.*

NAVAL HISTORY.

JUNE, 1881.—*Time allowed, three hours.*

Starred questions are alternatives.

(1) Give some account of the discoveries of the early Phœnician and Egyptian galleys. (2) Give a brief description of the construction of Egyptian galleys. (3) Describe the Greek trireme and its use.

Describe the battle of Salamis, giving date, opposing forces, commanders, tactics, and results.

(a) Give an account of the improvements in ship-building made by the English; during the Dutch wars, and (2) during the eighteenth century. (b) Explain the terms: (1) *frigate*, (2) *close-hauled line ahead*, (3) *flush deck*, (4) *half deck*, (5) *quarter deck*.

*. (a) Show how the introduction of (1) *guns*; (2) *sails*; (3) *steam-engines*; (4) *torpedoes*, in ships of war, changed the methods of naval warfare. (b) When and where was the torpedo first used effectively?

Give a description of the first battle of the Texel, with date, opposing forces, commanders, and results.

(1) Explain *breaking the line*, and point out its advantages. (2) Tell in what century, and by whom, this maneuver was first used successfully in modern warfare, illustrating the action by a diagram. (3) Explain the object of this maneuver as practiced in Greek tactics.

Give a short and distinct account of the battle of Aboukir Bay, with diagram, with details as to single ships. Give also date, opposing forces, and commanders, and officers prominently engaged, position of battle-ground.

I. Give some account of the following officers, describing especially those qualities of mind and character in each one which bore upon his professional career, and mentioning the important events in the life of each: (1) Nelson, (2) Collingwood, (3) Boscawen.

I*. Explain the improvements or new applications of the *steam-engine* made by following: (1) Papin, (2) the Marquis of Worcester, (3) Watt, (4) Fulton, (5) Stephenson.

II. (1) Give a brief account of the only sea fight during the Franco-German war 1870-71, giving a description of the vessels, and the results. (2) Give a detailed account of the action off Iquique between two Peruvian iron-clads and two Chilean iron vessels.

II*. State the relative strength and distribution of the opposing naval forces at the beginning of the Russo-Turkish war of 1877-78, and give a full account of one of the important engagements of the war.

- Battle of Trafalgar: date, locality, opposing forces and commanders, tactical results on battle, effect on the course of the war. Draw and describe diagram of the battle.

* The starred question is an alternate.

IX*. Battle of St. Vincent: date, locality, opposing forces and command, and describe diagram. What can you say of the crews of the Spanish ships? briefly to the part taken in the engagement by Troubridge in the C. in the Captain, and Collingwood in the Excellent.

DEPARTMENT OF MODERN LANGUAGE

FRENCH.

JUNE, 1881.—Time allowed, five hours.

Translate into French.

HUMANITY.

A soldier of the American army was condemned to be shot. This soldier, by close economy, had been able, for several years, to support his mother.

General Washington, informed of the filial piety of the offender, pardoned the sentence, and only had him discharged from the regiment: "If we save a death," said he, "we should run the risk of killing three persons instead of one."

GREAT BRITAIN.

The British Empire comprises England, Ireland, and Scotland, with its dependencies. England is divided into fifty shires or counties. This country produces many celebrated horses. England has many colonial possessions. The East India Company, which is divided into three presidencies: Bengal, Madras, and Calcutta, the capital, is situated on the Ganges. These presidencies are the most fruitful of the plains of India. Madras is situated on the Coromandel coast, Bombay on the Malabar coast. The Sikhs, who possessed Lahore, the powerful empire, were defeated in four severe battles by the British in 1846.

London, on the Thames, the capital of England, is the most populous and important commercial city in the world. Its port often contains more than a thousand vessels. From the middle of London bridge the Thames offers the finest sight. The most remarkable buildings are St. Paul's Cathedral, the Tower, and Westminster Abbey, which contains tombs of members of the royal family and monuments of celebrated men. A great number of squares, planted with trees, embellish this capital, the streets of which are generally broad and clean. Edinburgh is the capital of Scotland; but Glasgow, situated on the Clyde, is its principal town. Dublin is the capital of Ireland. Near Inverness, a sea-fight was fought the tremendous battle of Culloden, which entirely destroyed the Stuarts.

Dictation.

(Taken from the "Conserit de 1813.")

... "Ah! le brigand. Dieu veuille qu'il entre encore une fois et qu'il fende la tête avec ma hachette."

Mr. Goulden était consterné.

"Comment! tu n'as pas crié que c'était faux!" dit-il; "c'est donc vrai!"

Et comme je baissais la tête sans répondre, joignant les mains, il me dit:

"Ah! la jeunesse, la jeunesse; cela ne pense à rien... Quelle est ta folle imprudence!"

Il se promenait autour de la chaubère; puis il s'assit pour essayer de se distraire. tante Grédel dit:

! mais ils ne l'auront pas tout de même; leurs méchancetés ne serviront à rien : Joseph sera déjà dans la montagne, en route pour la Suisse."

« Vous avez tort, mère Grédel, de parler comme vous faites et de lui donner un conseil.

« Mauvais conseil! dit-elle; vous êtes donc aussi pour faire massacrer les gens,

« Je répondit-il, je n'aime pas les guerres, surtout celles où des cent mille hommes la vie pour la gloire d'un seul. Mais ces guerres-là sont finies; ce n'est plus question de la gloire et des royaumes qu'on lève des soldats; c'est pour défendre le pays on a compromis la force de tyrannie et d'ambition. On voudrait bien la paix maintenant! Malheureusement, les Russes s'avancent, les Prussiens se mettent avec nos amis les Autrichiens n'attendent qu'une bonne occasion de nous tomber sur le dos si l'on ne va pas à leur rencontre, ils viendront chez nous, car nous allons avoir la guerre sur les bras comme en '93. C'est donc tout autre chose que nos guerres de 1812, de Russie et d'Allemagne. Et moi, tout vieux que je suis, mère Grédel, si la guerre continue à grandir et si l'on a besoin des anciens de la République, j'aurais voulu aller faire des horloges en Suisse, pendant que d'autres verseraient leur sang pour défendre mon pays. D'ailleurs, écoutez bien ceci: les déserteurs sont méprisés. Après avoir fait un coup pareil, on n'a plus de racines nulle part; on n'a ni père, ni mère, ni clocher, ni patrie . . . On s'est jugé soi-même incapable de le premier de ses devoirs, qui est d'aimer et de soutenir son pays, même lors de la mort."

GRAMMAR.

Write the following words: Mon, le sien, quel, lesquelles.

What different forms does the demonstrative adjective *ce* take before nouns?

How do you express in French the difference between *this* and *that*?

Write the plural formation of nouns and the principal exceptions.

How is the feminine of adjectives formed? Give exceptions.

Write the position of objective personal pronouns in simple and in compound tenses and also with the imperative mood.

What is the place of the adverb?

Write the names of primitive tenses of French verbs, and tell how the four conjugations are distinguished.

What mood do prepositions govern the verb? Give exceptions.

What tense is used to express continued, repeated, and also customary action?

What verbs require the dependent verb in the subjunctive? Give also five of the functions requiring the subjunctive.

When do the impersonal verbs, *il semble—il paraît* require the following verb in the subjunctive—and when is the verb put in the indicative?

What preposition must precede the infinitive limiting the meaning of an abstract noun?

Write the rules for the agreement of the past participle,—first with *avoir*,—also with *être*. Give an example of each one.

Which auxiliary is used with active verbs—which with the passive—which with reflexive?

What verbs being joined in construction with the same subject, in what mood do the first govern the second?

Write in a table: (a) present indicative, first person singular and plural; (b) second person singular and plural of imperfect; (c) second person singular and plural, first person singular and plural, subjunctive of *aller, venir, vouloir, pouvoir*, etc.

WRITING ON LA FONTAINE'S FABLES.

READING AND CONVERSATION.

N A R

SECOND CLASS.**DEPARTMENT OF SEAMANSHIP.****NAVAL TACTICS.****CADET-MIDSHIPMEN ONLY.**

JUNE, 1881.—Time allowed, four hours.

1. Draw a diagram of a fleet of 24 vessels in line, natural order, showing divided into divisions and squadrons, by whom commanded, and the position of commander-in-chief, division commanders, and squadron commanders. Draw a diagram of 12 vessels in column, natural order. Show the positions of the commander-in-chief, division commanders.
2. What is a general signal, and how is it made? How are vessels exempted from obedience to a general signal? What is a special signal, and how is it made? When is a manoeuvre commenced? What is a speed signal (day and night), and how is it used?
3. A fleet being in column of vessels, in natural order, heading north, form columns of vessels abreast by divisions at right angles to the original direction.
4. The fleet being in line heading north, form it into double echelons from the flanks of divisions, preserving the original direction.
5. The fleet being in line, heading north, form it into double echelons from the flanks of divisions on their left-centre vessels, preserving the original direction.
6. The fleet under sail, change from a single column of vessels to columns of vessels abreast by divisions, with the rear division to windward.
7. Change from line to double echelon inverted, from the right and left of the right centre vessel, fleet heading north.
8. The fleet in double echelon, what is the natural order, reverse order, inverted order, and reverse inverted order?

DEPARTMENT OF ORDNANCE AND GUNNERY**INFANTRY TACTICS.****CADET-MIDSHIPMEN ONLY.**

JANUARY, 1881.—Time allowed, four hours.

1. Describe the formation of a company of infantry, giving the posts of the sergeants, and music. How formed in two ranks and in fours.
2. To form line from column of fours; to the right or left.
3. Describe the formation of a battalion of infantry, posts of officers, and staff, general guides and markers, field music and band. Form the battalion.
4. The battalion being at a halt, "to break from column of divisions at full dress to column of companies."
5. Deploy a battalion forward as skirmishers. How are intervals closed and extended? The battalion being deployed as skirmishers, assemble the battalion.
6. Describe the dress parade of a battalion of infantry.

GUNNERY.**CADET-MIDSHIPMEN ONLY.**

JUNE, 1881.—Time allowed, four hours.

1. How is the battery of a ship of war supplied with powder? How are the scuttles arranged, and how many men are required for each chain of scuttles, and what are their duties?

2. Give the stations of a crew at a broadside gun, 16 men and a powder-man, giving the titles on the right and left sides of the gun, and the arms belonging to each man.
3. Give the words of command in their proper order in the exercise of broadside M. L. guns, and explain in detail the duties of each member of the gun's crew at the order "load."
4. Draw and give the nomenclature of the 3-inch B. L. R.
5. Describe the organization on board ship of the companies of infantry, the crews for howitzers and machine guns for service on shore, as given in the ordnance instructions.
6. Discuss the corrections for speed and wind in connection with pointing, and explain why the correction for speed is of important consideration in the service of modern ordnance.

DEPARTMENT OF STEAM ENGINEERING.

DESIGNING MACHINERY.

CADET-ENGINEERS ONLY.

JUNE, 1881.—*Time allowed, five hours.*

[Questions having the same number are alternates.]

1. (See Fig. 1.) Stroke of engine, 4, revolutions per minute, 100; the shaft revolves with uniform velocity: find the velocity of the piston when the crank is in the position shown.
2. Construct, by means of the odontograph, two teeth of a spur wheel of $\frac{1}{4}$ " diametral pitch having 32 teeth.
3. The mandrel of a lathe is to be driven at a series of 8 speeds increasing in geometric proportion with a common ratio of 2; the speed changes are effected by means of a pair of equal and opposite cone pulleys on mandrel and counter-shaft, and by back gear. Find a train for and make a sketch of the back gear, the pinions having 32 teeth.
- 4a. The length of the driving-arm of a Whitworth quick return motion is 3", and the ratio $\frac{\text{period of advance}}{\text{period of return}} = \frac{7}{5}$; find, graphically, the distance between the centres of the driver and follower, and the length of the slot.
- 4b. (See Fig. 2.) Construct a cam which, by oscillating through an angle of 45° with uniform angular velocity, shall give a uniform ascending and descending motion to a rod which moves in the path BB' . The cam is to move on an axis of which A is the trace, and is to give the ascending motion when moving in a left-handed direction.
- 5a. Two axes A and B meeting at an angle of 90° are so connected by level wheels that they revolve with an angular velocity, ratio $\frac{A}{B} = \frac{3}{5}$, the wheel B having 24 teeth. Find the number of teeth of the spur wheel whose teeth are developments of those of A .
- 5b. (See Fig. 3.) Axes MN and PQ revolve with equal angular velocities in a left-handed direction as viewed from the ends M and P respectively; connect them by flat bands and pulleys, the latter being 20" diameter. (Make the sketch to the given scale.)
- 6a. (See Fig. 4.) Determine the number and direction of the revolutions made by the wheel D while the arm E makes one revolution about the axis X , the wheel A being fixed.
- 6b. (See Fig. 5.) Determine the extent of the motion of the cutters for each revolution of the boring-bar.
- 7a. (See Fig. 6.) Find to the nearest $\frac{1}{4}$ " the travel of a slide-valve driven by the given link motion; the link block being at S . Also indicate the virtual angular advance.

7b. The crank of a steam engine is $10''$ from a dead centre when the slide-valve opens to admit steam, and the piston is at $\frac{1}{2}$ stroke from beginning when the steam cut off; width of steam port opening being $1''$: find the angular advance of the eccentric, the lap of the valve, the eccentric arm, and the amount of lead. Give answer to the nearest $\frac{1}{4}''$. (Angularities of connecting-rod not considered.)

8a. The diameter of the circle passing through the centres of the paddles of feathering-wheel is $20'$; immersion of centres of paddles, $2' 6''$; depth of paddles, $3'$; length of stem levers, $2'$; slip, 25 per cent.; the paddles leave water which is moving at with $\frac{1}{2}$ the velocity of the centre of the vertical paddle. Find the centre of the eccentric, making the construction to a scale of $\frac{1}{4}'' = 1'$.

8b. (See Fig. 7.) AB is the lower lever of the parallel motion of a steam indicator, the tracing-point being at the middle of the connecting link, and having a straight (approximate) stroke of $2''$; the fixed centre of the upper lever is in the line CD . Find the path of the tracing-point and the upper fixed centre.

9a. The temperature of a furnace is 3100° F., and that of the chimney-gases 550° : the combustion of 1 pound of coal gives 13800 thermal units; the mean rates of transmission of heat is 5000 units per hour, per square foot of heating-surface. Find how many pounds of coal per hour, and how many square feet of heating-surface are required to evaporate 2400 pounds of water per hour from 120° F. to steam of 51 pound pressure per gauge.

9b. A certain engine requires 1,200 pounds of steam per hour at a temperature of 300° F.; temperature of feed water, 120° F.; density of feed water = $\frac{1}{2}$ per hydrometer; density of water in boiler = $1\frac{1}{2}$ per hydrometer. Find the weight of feed water per hour, and the percentage of heat lost in the water blown off, to keep the water at the required density.

10a. Find the volume of a jacketed cylinder for a condensing-engine to develop 800 HP under the following conditions: Saturated steam of 75 pounds per gauge initial pressure; cut off at $\frac{1}{2}$ stroke from beginning; clearance = $\frac{1}{2}$ piston displacement back pressure before closing exhaust valve = 4 pounds; final pressure of recompression = 16 pounds; revolutions per minute = 80.

10b. From indicator-diagram and data on sheet K, find the efficiency of the boiler.

11. Construct an indicator-diagram for a non-condensing engine of 33" stroke with 3" clearance; initial steam-pressure 57 pounds per gauge; the variations of pressures and volumes following Mariotte's law; the steam-valve opens at beginning of stroke and closes at 3" from beginning of stroke; exhaust-valve opens $1''$ from end of stroke and closes $9''$ from end of stroke. (Scale of pressures, $\frac{1}{16}'' = 1$ pound; scale of stroke, $1\frac{1}{2}'' = 1'$.)

12. The indicator-diagram on sheet K was taken from the engines of a ship steaming 10 knots per hour. New engines are to be built to drive her 12 knots per hour with a mean piston pressure of 30 pounds per square inch, and a piston speed of 34 feet per minute: find the required piston area in square feet, the percentage of loss from slip, friction, etc., remaining the same.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.

CADET-MIDSHIPMEN.

JANUARY, 1881.—Time allowed, four hours.

1. When is a transit instrument accurately adjusted in the plane of the meridian? What is the chief use of the altitude and azimuth instrument? State, without explaining, five reasons which tend to prove the rotation of the earth on its axis. State the lengths of the polar and equatorial diameters of the earth.

How would you construct a vernier to read to $7\frac{1}{2}$ seconds of arc, the limb being divided to $7\frac{1}{2}$ minutes? What is the cause of the index-error of a sextant, and how is it applied to an observed altitude? Give the signs of application to an observed altitude of refraction, parallax, and dip, and the reason for each.

Explain the methods of the text for finding the latitude at sea. How is the longitude found at sea, using a chronometer? Define solstitial colure.

Define equation of time in terms of hour-angle, and of longitude and right ascension. To what two causes is it due? State the law of universal gravitation, and apply it in the case of the moon.

State Kepler's laws. What is the cause of precession? Define sidereal, tropical, anomalistic years, and state the causes of the differences of their lengths. Which is used in the calendar, and why?

Deduce formulas for finding the distance of the moon from the earth. Find the real period of the moon. What causes the moon's libration in longitude?

State the seven elements of a planet's orbit. An occultation occurring at new moon, will the star disappear behind the bright or dark limb of the moon?

State the causes of the daily inequality of the tides. How can you determine the corrected establishment of a port? What causes spring-tides, and when do they occur? Which of the tides of a certain day will be the higher, and why?

What is the difference between a parallel of latitude and a circle of latitude? How does it occur the apparent retrograde motion of an inferior planet? Explain the phenomena presented by Jupiter's satellites.

What are comets, shooting-stars, and aerolites? When do the most prominent showers occur? State the elements of the parabolic orbit of a comet. How are they catalogued? What is a binary star? What is the difference between astronomical and civil time?

ASTRONOMY.

CADET-MIDSHIPMEN.

JUNE, 1881.—*Time allowed, four hours.*

It is intended to place a light which shall be visible at a distance of thirty sea miles to an observer twenty feet above the water. Required, the necessary height of light.

June 20, 1881, in Long. 6^h E. Required, the time of p. m. high-water, the establishment being $6^h 20^m$; required, also, the moon's declination at the instant of high-water.

June 5, 1881, at Annapolis. Lat. $38^\circ 58' 53''$ N. Long. $5^h 5^m 56.5$ W. Required, local mean time of the transit of Jupiter, and its meridian altitude.

June 5, 1881, at $8^h 30^m$ a. m. local mean time, the true distance of the moon from sun is $94^\circ 30'$. Required, the longitude. [Work to second differences.]

June 5, 1881, at Annapolis. A bright star is seen crossing the meridian at $9^h 11^m$ a. m. at an altitude of about 71° , and bearing south. Required, the name of the star. [Show work.]

June 5, 1881, in Long. 6^h E. W. T. obs. $10^h 10^m 30^s$ a. m. C—W $8^h 20^m 0^s$ C. C.—W 20^s . Required, the local sidereal time; also the hour angle of the star Sirius.

June 5, 1881, at 5 p. m. Greenwich mean time. Observed altitude of moon's upper limb $35^\circ 20' 0''$. Height of eye, 25 feet. In. cor., $+2' 0''$. Required, the true altitude of the moon's centre. At same time, the observed double altitude of sun's upper limb by artificial horizon is $80^\circ 0' 0''$. In. cor., $+2' 0''$. Required, the true altitude of the sun's centre. At same time, the observed altitude of a star is $35^\circ 0' 0''$. In. cor., $+2' 0''$. Height of eye, 25 feet. Required, the true altitude of the star.

ASTRONOMY.

CADET-ENGINEERS.

JUNE, 1881.—*Time allowed, four hours.*

1. Illustrate by a figure and define vertical circle, prime vertical, altitude, azimuth, hour angle, right ascension, declination, and the parts of the astronomical triangle. Define solar and sidereal time.
2. What is the astronomical clock, and how is its error found? When is a transit instrument accurately adjusted? What are the uses of the meridian circle and altitude and azimuth instrument?
3. Show how the form of the earth and the length of its radius are determined. Explain briefly the different proofs of the earth's rotation on an axis. What is the cause of the moon's libration in longitude?
4. Define elliptic, vernal equinox, solstitial colure, sidereal, tropical, and anomalistic years. Explain, and illustrate by a figure, the determination of the elliptical form of the earth's orbit.
5. State the cause of the change of seasons and of what this cause is the result. Explain the origin of the calendar now in use. What is nutation?
6. Deduce the formulas for determining the distance of the moon from the earth. State the distance.
7. At what phase of the moon does a lunar eclipse occur? State the different kinds of lunar eclipses and of solar eclipses. Which occur more frequently, and why? Which are seen more frequently at any place, and why?
8. State the causes of the tides and the causes of the daily inequality of the tide. Which tide of the day will be the higher? What is priming, and when does it occur? Name the planets in the order of distances from the sun, and in the order of magnitudes, and state the number of satellites by which each is attended.
9. What recently discovered fact tends to disprove the nebular hypothesis? What is the late theory regarding the composition of comets? Upon what depends the angular length of a comet's tail? State the five elements of a comet's orbit (parabolic).
10. Into what classes are meteors divided? In what months do the most prominent star-showers occur? How are fixed stars classified, and how catalogued? What is the distinction between double and binary stars?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT.

JUNE, 1881.—*Time allowed, four hours.*

[Ten questions required; viz., the seven starred and any other three.]

- 1*. What precautions must be observed in determining the boiling point of water? What are the English and French standards of length and mass? Define specific heat and latent heat. Why does a pond 4 feet deep freeze over more quickly than one 40 feet deep?
- 2*. You have taken ashore at Toulon an English-made barometer to compare with a French standard barometer (both scales brass). The English reads 29.34 in. French, 722mm; temperature 10° C. What is the error of your barometer? Coefficient of expansion of brass is .000019.
- 3*. Explain fully Regnault's method of determining the absolute dilatation of mercury, and derive the formula.
4. Define dew-point, relative humidity, hygrometric quality. Explain the wet and dry bulb hygrometer.

Find the weight of a litre of air, temperature of dry bulb 20°C ., wet bulb 15°C ., barometer 755^{mm}, maximum tension corresponding to $15^{\circ} = 12.7^{\text{mm}}$, specific gravity aqueous vapor 0.6235, specific heat of air 0.2375.

What will be the true weight of a body (specific gravity of substance being 2.5) which weighs 100 grammes in the air of which the weight was determined in previous question? Specific gravity of weight, 9.

What relation exists between the radiating and absorbing powers of vapors, and does this explain the presence of dark lines in the solar spectrum? What is meant by intensity of heat rays?

Explain the flow of heat across a wall, and also the difference between transmission of heat and transmission of temperature.

How many litres of steam at 100°C . will be necessary to melt 10 kilogrammes of ice at 0°C . and raise the temperature to 23°C .?

Make a careful drawing of Regnault's apparatus for determining the specific heat of gases, and explain how the weight of gas which passes through the calorimeter is determined.

Given the specific heat of air under constant pressure (0.2375), find the specific heat of air, the volume remaining constant. Specific gravity of Hg. 13.596.

A rain-drop falls from the height of $1\frac{1}{2}$ miles. How much would its temperature be raised, assuming that it imparts no heat to the air or the ground? The heat required to raise a pound of water from 0°C . to 200°C . and vaporize it, represents mechanical work which would be sufficient to raise a ton weight through what height?

State what transformations the heat generated in a furnace of a steamship undergoes, and what finally becomes of it.

Prove that there can be no lower temperature than the zero of the absolute scale.

CHEMISTRY.

JANUARY, 1881.—Time allowed, four hours.

Two questions are numbered alike, each cadet will elect which he will answer. No mark will be given on more than one of these questions.]

State the laws of definite and multiple proportions, and illustrate them by the case of nitrogen.

State the three laws which govern the gaseous condition of matter.

Define atom; molecule; analysis; synthesis; specific gravity.

Under what four heads may all chemical reactions be grouped? Define each.

Show by graphic symbols what is the condensation ratio of H_2O , HgO , H_2N , H_2P , CdCl_2 .

Prove that the specific gravity, referred to H, of a substance in the state of a gas gives us one-half its molecular weight.

Analyze the following reaction: $2\text{KNO}_3 + \text{S} + 3\text{C} = 3\text{CO}_2 + 2\text{N} + \text{K}_2\text{S}$.

By the action of sulphuric acid on potassium chloride, perchloric oxide, potassium perchlorate, hydrogen potassium sulphate, and water are found. Write the equation.

Write the chemical names for Ag_2S , $\text{Pb}(\text{NO}_3)_2$, H_2SO_4 , H_2SO_3 , Na_2SO_3 , $\text{Ba}_2(\text{C}_2\text{H}_3\text{O}_2)_2$.

Write the formulas for sodium oxide, sodium hydrate, sodium nitrate, calcium nitrate, calcium sulphite, calcium sulphide, ferrous chloride, ferric chloride.

What volume of pure glycerine (Sp. Gr. 1.26) will be required to furnish 1 kilo. of nitro-glycerine? How is nitro-glycerine made?

The percentage composition of a gun cotton being C24.24, H2.36, N14.14, and O61.44, find its simplest empirical formula.

Five grammes of a gunpowder gave on analysis 3.75 grms. of KNO_3 , 1.13 grms. of BaSO_4 . Calculate the percentage composition.

Describe the process for making cast iron; wrought iron; steel by the cementation process; steel by Bessemer process.

Iron rust destroys sails. Charcoal destroys sewer gases. Explain the action of these substances, and give other examples of this action.

10. In two similar jars, filled with O, equal weights of C are burned. In experiment 1 the charcoal is in one mass. In experiment 2 it is powdered. Compare quantity and intensity of the energy developed in each case.

10*. What constitutes an explosion? To what do explosives owe their energy?

11. What are the relative advantages of Chili and India saltpetre for use as powder? How may they be distinguished from each other? What are the uses of each?

11*. Why is H_2SO_4 used in making nitro-glycerine? Give other examples of which depend on the same characteristic.

12. What is dynamite? Gum dynamite or explosive gelatine?

12*. Write the graphic formula for glycerine, and show how its various nitro-substitution products may be found. What is a nitro-substitution product?

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

CALCULUS.

JANUARY, 1881.—Time allowed, four hours.

1. Given $y = \frac{b}{3a^3} \log \frac{a + bx^3}{x^3} - \frac{1}{3ax}$, to find $\frac{dy}{dx}$;

and $y = \left(\frac{a+b}{ab^3} \right)^{\frac{1}{3}} \tan^{-1} \left[\frac{\sqrt{a} \tan x}{\sqrt{a+b}} \right] - \frac{x}{b}$, to find $\frac{dy}{dx}$

2. Evaluate $\frac{x(\varepsilon^{2x} + \varepsilon^x)}{(\varepsilon^x - 1)^3} - \frac{2\varepsilon^x}{(\varepsilon^x - 1)^2} \Bigg]_0$, and $\left(\frac{\log x}{x} \right)^x \Bigg]_0$.

3. (a) If a square piece of sheet-lead whose side is a have a square cut out at its corner, find the side of the latter square in order that the remainder may form a tray of maximum capacity.

(b). A cylindrical trough is constructed by bending a given rectangular sheet of its breadth being denoted by $2a$; find the radius of the cylinder when the capacity of the trough is a maximum.

4. (a) Expand $\frac{\varepsilon^x}{1+x}$ in powers of x ; find five terms.

(b) Given $\log \left(\frac{n+h}{n} \right) = 2 \left[\frac{h}{2n+h} + \frac{1}{3} \frac{h^2}{(2n+h)^2} + \frac{1}{5} \frac{h^3}{(2n+h)^3} + \dots \right]$

and $\log_e 2 = 0.6931472$, compute $\log_e 17$.

5. (a) Trace the curve $y^2(x-a) = x^3 + ax^2$. (b) Derive the equation—

$$\frac{ds}{d\theta} = \left[r^2 + \left(\frac{dr}{d\theta} \right)^2 \right]^{\frac{1}{2}}.$$

6. Derive the expression for the radius of curvature in rectangular co-ordinates and find the radius of curvature of the ellipse.

7. Find the value of $\int_2^{\infty} \frac{x^2 dx}{(x-1)^2(x^2+1)}$, and of $\int_1^{\infty} \frac{(x+1) dx}{x(1+x^2)}$.

8. Integrate $\frac{d\theta}{\sin \frac{1}{2} \theta \cos \frac{1}{2} \theta}$, and find the whole area between the axis of x and

curve $y(a^2 + x^2) = a^3$.

9. (a) Find the area of the trochoid $x = a\psi - b \sin \psi$, $y = a - b \cos \psi$.

(b) Find the length of the cardioid, $r = a(1 + \cos \theta)$.

10. (a) Find the area included between the curves,
 $y^2 - 4ax = 0$, and $x^2 - 4ay = 0$.

(b) The curve $xy^2 = 4x^2(2a - x)$ revolves about its asymptote; find the volume generated.

Extra question.

(a.) Find the volume of a barrel whose height is $2h$, and whose longitudinal section through the centre is a portion of an ellipse, the foci being at the ends of the barrel, and whose transverse diameter is $2b$.

(b.) Evaluate $\int_0^1 \frac{\log x \, dx}{(1-x)^{\frac{1}{2}}}$.

MECHANICS.

JUNE, 1881.—Time allowed, four hours.

1. A weight of 6 pounds resting on an inclined plane whose height is 3 feet and whose base is 4 feet is attached by a string to an equal weight hanging over the top of the plane; find how much must be added to the weight on the plane that there may be equilibrium, and determine the pressure on the plane.

Two small rings slide on the arc of a smooth vertical circle, a string passes through both rings and hangs below the arc, three equal weights being attached to it, one at each end and one on the portion between the rings; find the position of the rings when they are in equilibrium.

2. A heavy uniform rod is capable of moving in a vertical plane about a hinge at one extremity; a string fastened to the other extremity passes over a smooth peg vertically above the hinge, and at a distance from it equal to the length of the rod, and has a weight P attached to it; determine the position of equilibrium of the rod, and its pressure on the hinge.

Or—

2. Construct a screw such that a force of 112 pounds acting on an arm of ten times the radius of the screw may raise 5 tons.

3. Two right cones have a common base and have their vertices on the same side of the base; determine the centre of gravity of the solid included between these cones.

Find the centre of gravity of the solid formed by the revolution of the sector of a circle about one of its extreme radii.

4. Derive the equation of the catenary.

Or—

4. A man walks with uniform velocity in a straight line dragging after him a weight attached to a rope whose length is a , the initial position of the weight being in a perpendicular to and at the distance a from the straight line; determine the equation of the path described by the weight.

5. Derive the laws of falling bodies.

A body dropped from the top of a tower whose height is 60 feet, reaches the bottom of a well at the foot of the tower in 3 seconds; find the depth of the well.

6. A body describes, in successive intervals of 4 seconds each, the spaces 24 feet and 64 feet in the same straight line; determine the accelerating force and the velocity at the beginning of the first interval.

Prove that the momentum of a system is the same after impact as before, and that the relative velocity after impact is $-\epsilon$ times the relative velocity before impact.

7. A ball moving on a smooth horizontal table impinges on two others in all respects like it which are lying in contact, at the same moment; determine the mutual elasticity of the balls if the impinging one is brought to rest.

The earth being regarded as a sphere of uniform density, derive a formula for determining gravity at any place.

8. Find the time of oscillation of a single pendulum (three terms)

Given the radius of gyration of a body about an axis through the centre of mass parallel to the axis of suspension, and the distance between these axes; deduce a formula for determining the length of the equivalent simple pendulum.

9. The directive force tending to restore a magnetic needle to its initial position when deflected, being proportional to the deflection and acting at the pole magnet, find the time of one oscillation.

Or—

9. Determine the radius of gyration of a chord, subtending the angle 2α at the centre of a circle whose radius is a , about an axis passing through the centre of the circle perpendicular to its plane.

FOR CADET-MIDSHIPMEN.

10. Show that the time of describing any portion PQ of the path of a projectile is proportional to the difference of the tangents of the angles which the tangents at P and Q make with the horizon.

Divide a rectangular aperture in the side of a vessel, kept constantly full of fluid to the top of the aperture, by a horizontal line so that the quantities discharged per unit of time from the two apertures may be equal.

FOR CADET-ENGINEERS.

10. A rod, whose length is 20 feet and transverse section is half of one square inch, bears a dead load of 5,000 pounds; find the live load that will produce an increase of elongation of another tenth of an inch.

A wagon weighing 5 tons and attached to a rope worked by a stationary engine going down an inclined plane at the rate of four miles per hour, when it is suddenly stopped; find the greatest tension on the rope, which has a sectional area of four square inches, and is 600 feet in length. $E=25,000,000$, $g=32$.

Extra question.

Find the centre of gravity of the portion of the solid $z^2=xy$ which is cut off by five planes $x=0$, $y=0$, $z=0$, $x=a$, $y=b$.

Find the centre of pressure on one loop of the lemniscate, $r^2=a^2 \cos 2\theta$, the line being vertical, and the node in the surface of the fluid.

DIFFERENTIAL AND INTEGRAL CALCULUS.

ELECTIVE COURSE.

JANUARY, 1881.—Time allowed, four hours.

Cadet-Midshipmen L. Nixon, J. T. Arnold, and S. S. Wood.

Cadet-Engineers R. W. Gatewood, E. Theiss, G. R. Ferguson, J. H. Pitts, and W. Creighton.

1. Evaluate $\int_0^1 \frac{(1+x)^{\frac{1}{2}} - \varepsilon}{x} dx$, and find the value of $\frac{dy}{dx}$ at a , having given $x^3 - 3axy + y^3 + a^3 = 0$.

2. Given $\frac{x}{e^x - 1} = 1 - \frac{x}{2} + B_1 \frac{x^2}{1 \cdot 2} - B_2 \frac{x^4}{1 \cdot 2 \cdot 3 \cdot 4} + B_3 \frac{x^6}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6} - \dots$, derive for $\theta \cot \theta$.

Prove De Moivre's theorem, and thence show that $\sqrt[n]{i} = \varepsilon^{\frac{\pi}{2n}}$.

3. Trace the curve $y(1 + \varepsilon^x) = x(1 - \varepsilon^{\frac{1}{x}})$.

If $x = a\varepsilon^\theta \cos \varphi$, and $y = a\varepsilon^\theta \sin \varphi$, prove that

$$y^3 \frac{d^3 u}{dx^3} - 2xy \frac{d^3 u}{dx dy} + x^2 \frac{d^3 u}{dy^3} = \frac{d^3 u}{d\varphi^3} + \frac{du}{d\theta}.$$

Prove Lagrange's theorem, and expand y^3 in powers of x , having given $y = a + xy^2$. Trace the curve $y = x^2 \operatorname{cosec}^3 x$, and find the area between the curve and the axis from $x = 0$ to $x = \frac{\pi}{2}$.

Evaluate $\int_0^{\frac{\pi}{2}} \frac{\log x dx}{a^2 + x^2}$, and express in gamma-functions $\int_0^1 (1-x^2)^{\frac{1}{2}} x dx$.

Find the area of the loop of the curve $x^6 + y^6 - 5ax^2y = 0$.

Find the length of the curve

$$y = \frac{a}{2} \left(\varepsilon^{\frac{x}{a}} + \varepsilon^{-\frac{x}{a}} \right), \quad x = \frac{1}{2} \left[y \left(\varepsilon^{\frac{x}{a}} - \varepsilon^{-\frac{x}{a}} \right) - 2x \right].$$

The axis of a right cone coincides with the generating line of a cylinder; the vertex of both cone and cylinder is equal to the common altitude; find the volume and the surface of each of the parts into which the cone is divided by the cylinder.

MECHANICS.

ELECTIVE COURSE.

Let-Midshipmen L. Nixon, J. T. Arnold, and S. S. Wood.

Let-Engineers R. W. Galewood, E. Theiss, W. H. P. Creighton, G. R. Ferguson, and Pitts.

A man is in a boat on a river at a distance a from the shore and b from a fall-water ahead; if the velocity of the stream be V , prove that he cannot escape the

unless he can row with a velocity $\sqrt{a^2 + b^2} V$, and that, in case he can row at this

the direction in which he must row is at right angles to the line joining his position with the point of the bank opposite the fall. Find also the direction in which he will have the least distance to row to reach the bank, supposing his velocity greater than this minimum.

A particle acted upon by two centres of attraction, each attracting with an intensity varying inversely as the square of the distance, is projected from a given point between them; find the velocity of projection that the particle may just arrive at the initial point of attraction and remain at rest there.

A fine thread having two weights each equal to P suspended at its extremities over two smooth pegs in the same horizontal line; a weight Q is then attached to the middle portion of the string between the pegs and allowed to descend under gravity; find the velocity of Q at any depth below the horizontal line.

Show that the velocity at any point of a central orbit is independent of the path described, and depends solely on the intensity of the attraction, the distance of the particle from the centre, and the velocity and distance of projection.

Find the law of attraction in order that a particle may describe the lemniscate $r^2 \cos 2\theta$, the centre of attraction being at the pole.

One particle begins to fall from the higher extremity of a vertical line, and at the same instant another is projected upwards from the other extremity with a given velocity, the particles moving in a medium of which the resistance varies as the velocity; show that the time at which they will meet will be $\tau \log \frac{V\tau}{V\tau - a}$, where a is the length of the line, V is the velocity of projection, and the retardation due to the resistance is $\frac{1}{\tau}$ of the velocity.

A heavy particle is projected from a given point in a given direction with a given velocity, and moves in a uniform medium, whose resistance varies as the cube of the velocity; determine the motion of the particle.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND
LAW.

NAVAL HISTORY.

JANUARY, 1881.—*Time allowed, four hours.*

[Omit any four of the questions, except I, XI, XII.]

I. Give an account of any three of the following officers: (1) Barry, (2) Morris, (3) Bainbridge, (4) Stockton, (5) Cushing, (6) Blakeley.

II. Give a general account of the measures attending the development of the navy from 1794 to 1812, showing how the service was regarded by political parties at the country at large, and how naval development was advanced or retarded.

III. Discuss the affair of the Chesapeake and Leopard, showing how it came about and stating the circumstances attending the affair.

IV. Describe briefly Preble's six attacks on Tripoli.

V. Give a complete tactical description of the battle of Lake Erie, showing the order of attack, opposing forces, and details of action, with diagram of engagement.

VI. Give an account of the cruise of the Ranger under Paul Jones in 1778, and a brief outline of Jones's character.

VII. The cruise of the Essex.

VIII. State briefly the naval operations on the east coast of Mexico during the years of 1846-48, and describe fully the share of the Navy in the reduction of Vera Cruz.

IX. Give a complete tactical account of any one of the four frigate actions of 1812, stating dates, commanders, comparative force, details of action, important incidents and results, with diagrams.

X. Give an account of the leading events in the French war of 1798.

XI. Describe the two actions of the Merrimac on the 8th and 9th of March, 1862.

XII. Give a full account of the battle of Mobile Bay.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

JUNE, 1881.—*Time allowed, four hours.**Translate into French.*

THE CONSULAR GUARD AT MARENGO, JUNE 14, 1800.

At dawn of day, the Austrians crossed over three bridges which they had built across the Bormida, and furiously assaulted the village of Marengo.

After having sent to Desaix, who was a half day's march in his rear, the order to return with his corps to Saint Giuliano, the First Consul hastened to the field of battle. It was ten o'clock in the morning. The enemy had carried Marengo; Victor's division, after the most spirited resistance, was routed, and the field to the left was covered with soldiers in flight. To the right, Lannes was struggling against the corps of the Austrian General Ott, who, being master of the village, already outflanked the French divisions he had before him.

The First Consul, knowing that success depends on maintaining the communication between his right wing and the rest of his army, gives the order to the foot guards of the consular guard, to resist this movement of the enemy. These eight hundred brave men form a square which, like a granite redoubt, sees the most terrible assault of Austrian cavalry break against its steadiness. It was then three o'clock in the afternoon, and every one thought the battle lost.

las, worn out with fatigue, thinking the victory sure, had recrossed the bridges at Bormida, and returned to Alexandria, leaving to General Zach the task of pursuing the French army. Bonaparte alone did not despair, and counted on Desaix's aid, with six thousand fresh troops. It was five o'clock when Desaix reached the field. In Bonaparte's hands, this re-inforcement is to become the means of victory, and the army is inspired with the confidence of its chief. Wearied by its long bloody retreat, it sees, with inexpressible joy, Desaix's division cover the left. "Liers," cries Bonaparte, "this is the moment to advance: remember that I am doomed to sleep on the battle-field."

AN ANECDOTE OF LOUIS XVIII.

After the Restoration in 1814, among the titled followers of Napoleon who were most anxious to obtain employment at the Court of Louis XVIII, none showed more serenity or assiduity to accomplish his purpose than Fouché, Duc d'Otrante. He at last had a private interview with the King, when he expressed his desire to dedicate himself to his service.

The King replied: "You have occupied under Bonaparte a situation of great trust, and must have given you opportunities of knowing everything that passed, and of gaining an insight into the characters of men in public life, which could not easily be given to others. Were I to decide on attaching you to my person, I should previously require that you would frankly inform me what were the measures, and who were the persons that you employed in those days to obtain your information. I do not allude to my stay at Verona or Mittau—I was then surrounded by numerous adherents; but at well, for instance—were you then well acquainted with what passed under my eye?"—"Yes, sire, every day the motions of your Majesty were made known to me."—"But what! surrounded as I was by trusted friends, who could have betrayed me? How abused my confidence? I insist on your naming him immediately."—"Sire, I dare not say what must wound your Majesty's heart."—"Speak, sir; kings are not so subject to be deceived."—"If you command it, sire, I must own that I was in correspondence with the Duc d'Aumont."—"What! De Piennes, who possessed my confidence? I must acknowledge," added the King, with a malicious smile, "that he was very poor, he had many expenses, and living is very dear in England. Well, Fouché, it was I who dictated to him those letters which you received every day, and gave up to him twelve thousand out of the forty-eight thousand francs that you so regularly remitted to obtain an account of all that was passing in my reign."

Translate into French.

THE DEATH OF CÆSAR.

As the civil wars were being ended, Cæsar, appointed dictator for life, began to display his greatness. The Senate having come to him, he received it sitting, and glanced with indignation at one who advised him to rise. Antony having placed on his head a crown, at a time when he was seated before the rostrum, Cæsar seemed not at all to disapprove of this action. That very day more than sixty citizens, having at their head Cassius and Brutus, conspired against him. Cæsar having taken his place with the Senate on the ides of March, the conspirators surrounded him, as if to pay their respects. Suddenly one of them approached him under pretext of asking a favor, and in refusal, pulled the robe from off his shoulders. Cæsar cried out: "Violence is done to me!" At the same time Cassius stabbed him with a dagger under the throat. Antony seized Cassius' arm and pierced it with his stiletto; he attempted to run away, and received a second wound. Brutus, whom he regarded as his son, having thrown himself on him, he said to him: "And you also, my son!" At length, perceiving the attacks directed against him on all sides, he wrapped his head in his robe, and fell, and died with twenty-three wounds.

Translate into English.

PASSAGE DU SAINT BERNARD, MAI 1800.

Tandis que l'Europe croit le premier Consul livré à Paris aux soins du gouvernement, il arrive à Genève et prend le commandement de l'armée; c'est là que, résolu à porter la guerre sur le Pô, il choisit la base de ses opérations sur les revers du Simplon et du Saint-Gothard. Rival d'Annibal et de César, il décide le passage de l'armée par la crête des montagnes, à plus de douze cents toises au-dessus du niveau de la mer. Les cartouches et les munitions renfermées dans de petites caisses, les affûts démontés, sont portés à dos de mulets. On a préparé des troncs d'arbres creusés de manière à pouvoir contenir nos pièces de canon; cent soldats s'attèlent à chacune d'elles. Lannès commande l'avant-garde.

Trente-cinq mille Français, conduits par Bonaparte, abordent le Saint-Bernard. Moncey marche vers le Saint-Gothard avec quinze mille hommes, pour descendre Bellinzona. Au sein des rochers les plus escarpés, au travers de glaces éternelles, au milieu de neiges qui effacent toutes les traces et n'offrent plus qu'un immense désert par des chemins où le pied de l'homme n'avait jamais été empreint, les Français montrent un indicible courage: gravissant péniblement, près de succomber sous le poids de leurs armes, ils s'excitent les uns les autres par des chants guerriers. Après de grands dangers et des fatigues inouïes, l'infanterie, la cavalerie, les bagages, les canons, ont atteint les sommités des Alpes, où nos différents corps reçoivent des moines du Saint-Bernard les secours de la plus généreuse hospitalité.

Sur le versant méridional, la marche offrit plus de difficultés encore; les soldats, les généraux, Bonaparte lui-même, prennent le parti de se laisser glisser sur un glacier presque perpendiculaire.

SPANISH. ELECTIVE COURSE.

JUNE, 1881.—*Time allowed, four hours.**Cadet-Engineers J. H. Fitts, R. W. Gatewood, E. Theiss.**Translate into Spanish.*

Washington se démet du commandement militaire, qui lui avait été confié.

... Le congrès avait fixé le 23 décembre pour cette imposante cérémonie à laquelle affluèrent une foule immense de citoyens. Washington fut accueilli par cette nombreuse assemblée comme devait l'être le fondateur et le sauveur de la République.

Considérant, à leur tour, ce grand homme comme l'instrument dont la Providence s'était servie pour fonder l'indépendance et assurer la liberté de l'Amérique, les illustres membres de ce congrès éprouvaient pour lui des sentiments d'une vive reconnaissance et d'une sincère admiration: et au souvenir de l'étroite union qui avait régné entre eux et lui, aux jours de la lutte et des périls, ils ne purent maîtriser leur émotion: leurs yeux se remplirent de larmes.

Washington s'étant levé, se tourna vers le général Mifflin, président du congrès. Il lui dit de cet air de dignité qu'il tenait de la nature: "Monsieur le président, je vais ici me démettre du poste éminent auquel j'avais été appelé par le vœu de mes compatriotes et l'élection de leurs représentants.

"Pénétré de l'idée de mon incapacité, je n'avais accepté ce haut rang qu'avec crainte et défiance. Mais soutenu, tout à la fois, par la justice de notre cause, par l'appui que m'ont toujours prêté les sages citoyens auxquels notre naissante patrie avait confié ses destinées, et plus encore par la faveur du ciel, j'ai pu voir enfin nos vœux accomplis et la victoire couronner nos efforts et nos sacrifices.

"Aussi, plus je repasse en mon esprit les péripéties de cette lutte à jamais mémorable, plus je sens accroître mon affection pour mes frères d'armes, mon amour pour nos

pays, et surtout ma gratitude envers cette divine Providence qui n'a cessé de veiller sur nos armes et nous a enfin conduits au port du salut.

"En présence de ces bienfaits du ciel, comment, à ce dernier acte de ma carrière militaire, pourrais-je ne pas lui en rendre des actions de grâce, et invoquer sa protection sur cette patrie bien-aimée qui, sous sa garde, nous avons arrachée des mains de nos puissants ennemis : sur ces illustres chefs qui m'ont si bien secondé dans nos combats : enfin sur ces élus de la nation qui, après avoir dirigé l'état au fort de la tempête, sont aujourd'hui appelés à parfaire notre œuvre, en dotant le pays de lois qui en assurent l'union, la force et la durée.

"Monsieur le président, ma tâche est achevée. Voici mon brevet de commandant que je dépose entre vos mains. Mais au moment de rentrer dans la vie privée, permettez-moi d'offrir, une fois encore, mes affectueux hommages à ce corps auguste que vous avez l'honneur de présider, d'après les ordres et les inspirations duquel, j'ai si longtemps combattu pour le maintien de nos droits et la défense de nos foyers."

Translate into French.

RAZONAMIENTO DE HERNAN CORTÉS Á SUS SOLDADOS.

"La causa de Dios y la de nuestro rey nos lleva á conquistar regiones no conocidas. No es mi ánimo facilitaros la empresa que acometemos: combates nos esperan sangrientos, facciones increíbles, batallas designales en que habreis menester socorremos de todo vuestro valor; miserias de la necesidad, inclemencias del tiempo, y asperezas de la tierra en que os será necesario el suprimiento, que es el segundo valor de los hombres, y tan hijo del corazon como el primero; que en la guerra mas veces sirve la paciencia que las manos. Hechos estais á padecer, y hechos á pelear en estas islas que dejais conquistadas; mayor es ahora nuestra empresa, y debemos ir prevenidos de mayor osadia; que siempre son las dificultades del tamaño de los intentos. Pocos somos; pero la union multiplica los ejércitos, y en nuestra conformidad está nuestra mayor fortaleza. Uno, amigos, ha de ser el consejo en cuanto se resolviere; una la mano en la ejecucion, comun la utilidad, y comun la gloria de lo que se conquistare. Del valor de cualquiera de nosotros se ha de fabricar y componer la seguridad de todos. Vuestro caudillo soy, y seré el primero en aventurar la vida por el menor de los soldados; mas tendreis que obedecer en mi ejemplo que en mis órdenes; y puedo aseguraros de mi que me basta el ánimo á conquistar un mundo entero, y aun me le promete el corazon con no sé que movimiento extraordinario, que suele ser el mejor de los presagios.

"Alto, pues; á convertir en obras las palabras; y no os parezca temeridad esta confianza mia, pues se funda en que os tengo á mi lado, y dejo de fiar en mi todo lo que espero de vosotros."—*Solis.*

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

CADET-MIDSHIPMEN ONLY.

JUNE, 1881.—*Time allowed, five hours.*

1. A sailing-vessel having been in port for some time, get her ready for sea.
2. Get on board, rig, and send up a topsail-yard.
3. Lying in an open roadstead by the starboard anchor, head to wind, blowing out, get under way in the shortest manner possible.
4. Riding head to wind, with a shoal astern, close aboard, get under way and make sail by the wind on the starboard tack.

5. Give rules for managing boats in a surf, landing and embarking on the beaches, carrying weights, &c.

6. Make all preparations for a gale. Ship being under royals, state to you would reduce and all the preparations you would make.

7. Main tack and clew-garnet gone, what is to be done?

8. Describe the evolution of boxhauling a ship, and state when you would

9. Describe the indications of the approach of a hurricane, supposing you the southern hemisphere, wind E., E. N. E., and N. E., what semicircle are and how will you maneuver your vessel?

10. State the lights carried by steamers and sailing-vessels, tows, pilot-vessels at anchor.

SHIP-BUILDING.

JANUARY, 1881.—*Time allowed, five hours.*

WOODEN SHIP-BUILDING.

1. Give the order in which the work performed in building a ship is executed the order in which the different timbers composing a ship are put together.

2. Make a sketch of a transverse section showing all timbers cut by the section.

3. Describe fully the keelsons of a wooden ship, showing the fastenings.

4. Upon what does the transverse strength of a ship depend. Give a plan deck-framing of a ship, showing all the timbers.

IRON SHIP-BUILDING.

5. Describe the transverse system of framing, and explain how longitudinal is obtained in this system.

6. Describe the bracket system as employed in the construction of iron-clad

7. Describe in detail the best methods of bottom-plating. Are any of the plates connected with the decks? and, if so, how?

8. Describe the different kinds of beams and beam-arms and their connection the ship's side. Give the rule for the spacing of beams.

LAYING DOWN,

9. Explain the three plans used in laying down a ship.

10. Construct the body plan, showing how the square stations are got in and Lay off the joint (molding edge) of a cant in the body plan and end it, make horizontal ribband lines.

DEPARTMENT OF ORDNANCE AND GUNNERY

ORDNANCE AND ARMOR.

CADET-MIDSHIPMEN ONLY.

JANUARY, 1881.—*Time allowed, five hours.*

1. Define cast iron, wrought iron, steel, and bronze, and give the differences of each metal; discuss the properties of these metals as applied to the fabrication of ordnance.

2. Define smelting, casting, puddling, forging, shingling, and piling. What

3. Describe the fabrication of rolled armor plates.

4. Draw and describe the 80-pounder B. L. R.; give method of conversion and nomenclature.
 5. Describe the kinds of strain to which a gun is subjected; explain the two methods of equalizing the strains.
 6. Explain "uniform twist" and "increasing twist"; deduce the formula for the angle of rifling in both cases, and in the second case deduce the equation for the curve of the rifling.
 7. Define what is meant by a "system of rifling," and state what three systems are in general use; give an example of each.
 8. Describe the Bessemer process of making steel.
- Questions 7 and 8 are not required, but additional credit will be given if satisfactorily answered.

ORDNANCE AND ARMOR.

CADET-MIDSHIPMEN ONLY.

JUNE, 1881.—*Time allowed, five hours.*

1. What is drift? Discuss the deviation of rifled projectiles. What forms are usually given to the heads of rifled projectiles, and what influence does the shape of the head exercise on range and accuracy, and on the penetration of armor plates?
 2. Of what material are armor plates made, and what are the principal systems or forms of armor in regard to thickness of plate and material. What is compound armor and how is it fabricated? What is "backing," and what are its advantages? What advantages are claimed for deflection and air-spaces?
 3. Draw and describe the S. P. directing-bar carriage.
 4. Define the term "incorporation" as applied to the manufacture of gunpowder; explain the method of incorporation and give a description of an incorporating mill.
 5. What are fuzes? Give those used in the service. How are fuzes classified according to mode of operation; what is fuze composition, and upon what does its rate of burning depend?
 6. Define concisely and briefly the following terms used in the practice of gunnery: Line of sight; natural line of sight; line of metal; line of fire; angle of fire; angle of sight; dispart; plane of fire; plane of sight; point-blank range; range at level; extreme range; clearance angle.
 7. Problem. To determine the graduation of the rear sight.
 8. What is meant by concentrated fire; how calculate the angle of concentration—on the beam; on the bow or quarter?
- Answers to the following questions are optional, but credit will be given for each one satisfactorily answered:
9. Describe the Schultz chronoscope?
 10. Determine the distance of an object at sea by observing its angular distance from (within) the offing (Buckner's method).

DEPARTMENT OF STEAM ENGINEERING,

MARINE ENGINES.

CADET-MIDSHIPMEN.

JUNE, 1881.—*Time allowed, five hours.*

1. Saturated steam having a sensible temperature of $293^{\circ}.8$ is used in a steam-engine making 55 revolutions per minute; diameter of cylinder, 50 inches; stroke of piston, $3\frac{1}{2}$ feet; clearance, nozzles, etc., 3 per cent. of piston displacement per stroke;
- S N A E

steam is cut off at $\frac{1}{4}$ of stroke from beginning, expanding according to Mariotte's and exhausted against a back pressure of 3 pounds per square inch. Required, *mean effective pressure*; the *effective pressure at end of stroke*; the *pressure shown gauge*; the I. H. P. of the engine. $\log P = A - \frac{B}{T} - \frac{C}{T^2}$; $A = 8.2591$; $\log B = 3.43$ $\log C = 5.59873$.

2. What must be the steam pressure per square inch on the gauge for the engine example 1 to develop the same H. P. when the steam is cut off at $\frac{1}{4}$ of stroke from beginning, instead of $\frac{1}{2}$ (other conditions remaining the same); and how many pos of injection water at 70° Fahr. are required to condense the steam and maintain temperature of condenser (feed-water) at 120°. The exhaust steam reaching condenser at 233°. $\log V = 2.516 - 0.939 \log p$; V = volume of 1 pound of steam; p = absolute initial pressure.

3. The maximum speed of a steamer is 10 knots an hour on a consumption of 20 $\frac{1}{2}$ of coal a day. She has to make a voyage of 3000 knots, and steams two-thirds distance in 10 $\frac{1}{2}$ days; the remainder of the distance was made at the rate of 7 km an hour. Required, the *total* consumption of coal during the voyage.

4. One hundred pounds of fuel, composed of 90 per cent. C, 3 per cent. H, 3 per cent. O, 3 per cent. ash, and 1 per cent. water, is burned with 20 pounds air per pound of fuel at 70° Fahr. The products of combustion escaping up the chimney at 620° Fahr. The *mal* value of C = 14500 units, and of H = 50000 units. Specific heats: O = 0.212; CO = 0.217; N = 0.245; H₂O = 0.475. Required, the pounds of water evaporated per pound of fuel from and at 212° Fahr.

5. A steam engine using saturated steam in a jacketed cylinder develops 300 H. P. at 60 revolutions per minute with a steam pressure of (p_1) 90 pounds per square inch, absolute; stroke of piston, 3 $\frac{1}{2}$ feet; terminal pressure, (p_2) 21 pounds; back pressure, (p_3) 3 pounds; temperature of feed water, 120°; effective work per pound of steam, 136015 foot-pounds; foot-pounds due to *external work* at 21 pounds, 56912; volume of 1 pound of steam at 21 pounds pressure, 18.82 cubic feet. The fuel is capable of generating 14000 heat units, and the boiler utilizes 70 per cent. of heat generated. Required, the *pounds of coal* used per hour in the boiler, and area of piston of engine in square inches.

6. The legs of a siphon mercury gauge are to each other in area as 1 : 4. The small steam-pipe connecting gauge with boiler is 5 ($\frac{1}{2}$) feet high above surface of mercury in small leg. When pressure is applied, this pipe and that portion of the siphon tube from which mercury has been forced is maintained full of water. How high will the mercury rise in the large leg to indicate 60 pounds pressure? Density of mercury, 13.6; atmosphere, 30" mercury, or 15 pounds per square inch.

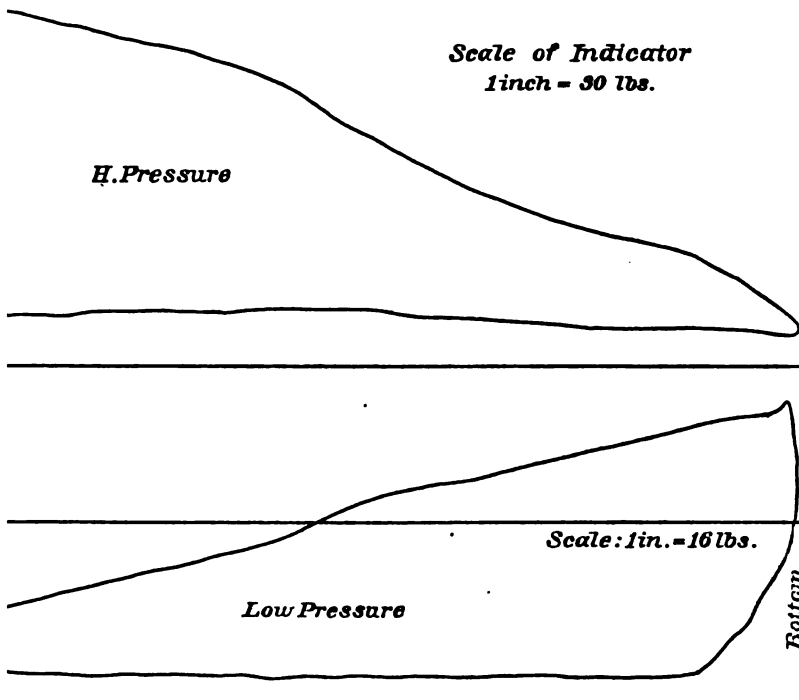
7. Sketch and explain the action of the Bourdon steam-gauge; demonstrate that the radius of curvature of tube varies as the minor axis of its elliptical cross-section.

8. The circumference of center of pressure of a four-bladed propeller is 30 feet; distance from hub to center of pressure, 3 feet; pitch of propeller, 20 feet; thrust 12000 pounds; breadth of blade at hub, 30 inches; the material of which the propeller is made can stand a pressure of 500 pounds per square inch of cross section acting through a leverage of 1 inch. Required, the mean thickness of blade at hub.

9. The water supplied to a boiler has a density of $\frac{1}{32}$ and temperature of 110° Fahr. the water in the boiler is maintained at a density of $\frac{1}{32}$ and temperature 284°. What is the loss by "blowing off"? Suppose the feed water was supplied at a temperature of 140° what would be the per cent. saved in fuel, the density and temperature of water in boiler to remain the same?

10. From the indicator diagrams (marked A and B) and data of a compound engine and assuming that 15 per cent. of the I. H. P. of engine is absorbed by friction, find the necessary weight to be suspended on the end of a balanced lever of a Prony dynamometer

to absorb the I. H. P. of engine not used in overcoming friction. Length of a center of shaft, 12 feet; diameter of low-pressure piston, 86 inches; diameter of high-pressure piston, 50 inches; stroke of pistons, $3\frac{1}{2}$ feet; revolutions of engine, 100 per minute.



t, 2d, 3d, 4th, 10th, and any three of the remaining five questions are re-
Unless all the required questions are attempted, no credit will be given for
extra ones.

MARINE ENGINES.

CADET-ENGINEERS.

JUNE, 1881.—Time allowed, five hours.

PART 1.

ence the value of the thermodynamic function in terms of the temperature
me as independent variables, explaining the process?

ence the law of the variation of the pressure with the volume of any fluid,
perfectly gaseous or not, inclosed in a non-conducting cylinder?

ence the formula for the total heat of gasification, having given

$$\phi = K_p \log_e \tau - \int_0^p \frac{dv}{\tau} dp$$

ence the value of the mean gross pressure when $p \propto u^{-1}$.

ence the value of the thermodynamic function for mixed steam and water,
it deduce the value of the ratio in which steam is expanded in a non-con-
ducting cylinder.

[Answers required to three of the above five questions.]

PART II.

6. The brake (Fig. 1) is applied on the propeller shaft to stop the ship revolving when under sail. Required, the weight to be applied at A to stop the shaft when revolving at the rate of 15 turns per minute. The effort to be applied is 1000 pounds applied at centre of pressure of screw-blade. Radius of centre of pressure = 6 feet. Coefficient of friction = 0.15.

7. Required, the pressure per gauge in the delivery chamber of a feed-pump deliver 60 cubic feet of water per minute into a boiler carrying 50 pounds per gauge. The feed pipe is 3" diameter and 40' long, having 5 right-angled bends.

8. Required, the weight of saturated steam per hour for a pair of double-acting engines of 60" diameter cylinder $\times$ 3 stroke. Cylinders jacketed. Revolutions per minute = 50. Clearance = 3 per cent. of piston displacement. Cut off at $\frac{1}{2}$ stroke. Initial pressure of steam = 40 pounds per gauge and its temp. 257° Fahr. No recompression.

9. Required, the per cent. of the steam that would be liquefied if a quantity of steam had been expanded down to a final pressure of 10 pounds per square inch (absolute pressure), its temperature at that pressure being 124° Fahr., and the initial steam had been non-conducting.

10. The pair of engines in question 8, working under the conditions there except that the mean back pressure is 5 pounds per square inch, used 75 per cent. power developed to drive the ship 12 knots per hour (1 knot = 6080 feet). Find the per cent. of the I. H. P. used to overcome the friction of the thrust-bearing, which consists of a single collar, on which the intensity of pressure is 2000 pounds per square inch. Diameter of shaft = 10". Coefficient of friction = 0.1.

11. A pair of double-acting engines (cylinders jacketed) give indicator card as in Fig. 2, and drive the vessel 14 knots per hour. Piston area of each cylinder = 2400 square inches. Stroke = 4'. Required, the pounds of coal per hour per I. H. P. in the engine (boilers, machinery, &c.), and the efficiency of the machinery (excluding propeller), having given the total heat of combustion of 1 pound of coal = 14,000 units, and the efficiency of the boiler = .60; resistance of the ship at that speed = 40000 pounds; clearance = 2 per cent. of piston displacement.

[Answers required to five of the above six questions.]

BOILERS.

CADET-ENGINEERS.

JUNE, 1881.—Time allowed, five hours.

Design boilers to supply steam for an engine of 2000 I. H. P. that uses 35 lbs. steam per hour per I. H. P.; the boiler pressure to be 60 pounds per gauge; the engine makes 50 revolutions per minute; volume of one pound of steam at 60 lbs. per gauge = 5.7 cubic feet; height of deck-beams from top of boiler keelson = 10 feet; breadth of ship that can be occupied by boilers and fire-room = 32'; coal to be supplied by natural draught.

1. Required, the total area of grate surface in square feet.
2. Required, the number and size of boilers, and the length of ship occupied by them.
3. Required, the number and size of furnaces in each boiler.
4. Required, the size of back-connection.
5. Required, the size and number of tubes for each furnace.
6. Required, the thickness of metal for shell, furnace flues, and tube sheets.
7. Required, the size of braces used and distance placed apart.
8. Required, the diameter and height of smoke-pipe.
9. Name all the attachments required for the boilers and where attached.

10. Required, the pounds of water evaporated from and at 212° Fahr. by a pound of coal composed of, C = .92, H = .036, and O = .023, burned with 24 pounds of air. Temperature of external air = 50° Fahr. and of products of combustion in chimney = 600° Fahr. Mean specific heat of products of combustion = 0.241. Loss of heat from radiation, leakage, &c. = 20 per cent. Required, the temperature in the furnace.

The following sketches are required, made to scale and giving dimensions:

1. Longitudinal section through centre of furnace and boiler, showing positions and forms of joints used on shell and in furnace, and how furnace flue is attached to front head and back tube sheet. Also show methods of bracing and attachment to rollers.

2. Front elevations to show positions of furnaces, tubes, and braces.

3. General plan of boilers and fire-room.

4. Write down all formulas explaining the terms used.

DESIGNING MACHINERY.

CADET-ENGINEERS.

JUNE, 1881.—Time allowed, five hours.

Length of ship on water line, 220 feet; beam, 40 feet; mean immersed girth, 40 feet; coefficient of augmentation, 1.3; displacement, 2,000 tons; area of immersed ship section, 450 square feet; speed, 10 knots per hour; H. P. of engines at that speed, 900. Required, (a) area of wetted and augmented surface in square feet; also, coefficient of propulsion. (b) Model of above ship is $\frac{1}{12}$ of dimensions of ship. Determine by Froude's law of comparisons the resistance of the model at a speed of 200 ft per minute. Net power required, to overcome resistance of ship = 40 per cent. (c) H. P. (e) Give coefficients of power for the above ship, on the displacement and immersed midship section.

What are the diameters of the high and low pressure steam-jacketed cylinders of a compound engine? Stroke of piston, 4 feet; clearance in each cylinder, $\frac{1}{12}$ of its free displacement; I. H. P., 1,000; revolutions per minute, 75; boiler pressure, 76 pounds per gauge; back pressure (minimum) in low-pressure cylinder, 4 pounds; ratio of expansion, 9; expansion curve $P \propto v^{-1.1}$; exhaust-valve closes when piston is 8 inches from either end of stroke in each cylinder; compression curve, $v^{-1.1}$.

Sketch a sectional view of the high-pressure cylinder in question 2, showing steam and exhaust ports, jacket space, piston and cylinder head. Give thickness of cylinder and working lining, depth of piston and cylinder head, distance between ports, width of steam and exhaust ports (single port) in inches.

Design a locomotive slide valve for an engine, stroke of piston 3 feet, to cut off each stroke 27 inches from the commencement; steam-valve to open the port when piston is 1" from the end of stroke on inboard end; exhaust-valve to close when the piston is 6" from the end of each stroke; length of connecting-rod, 6 feet; width of valve, $1\frac{1}{2}$ "; scale for crank-circle and stroke, $1\frac{1}{2}" = 1'$. Required, steam and exhaust valve lead at either end of valve, and throw of eccentric; engine direct-acting.

Meyer cut-off; stroke of piston, 3'; length of connecting rod, 6'; angle between crank and main eccentric, 120° ; between main and cut-off eccentric, 60° ; throw of main cut-off eccentrics, $2\frac{1}{2}"$; width of port in upper part of main valve, 2"; engine direct-acting. What is the length of each cut-off valve, to cut off at $\frac{1}{2}$ stroke from either end of cylinder? Pitch of screw for inboard cut-off valves = 4 threads to an inch. What is the number of threads to one inch for the outboard cut-off valve, to cut off at exactly $\frac{1}{2}$ and $\frac{1}{4}$ stroke from either end of cylinder. Sketch relative position of cut-off to main valve when piston is at $\frac{1}{2}$ stroke and valves set to cut off at $\frac{1}{2}$ stroke, giving dimensions.

A pair of engines (non-compound) for screw-propeller. Diameter of cylinders,

40"; stroke of piston, 4"; maximum effective pressure in cylinder, 40 pounds; effective pressure in cylinder, 30 pounds; cut off at $\frac{1}{4}$ stroke; cranks at right angles; revolutions per minute, 60. Required, length and diameter of crank-pin formula for length of crank pin; coefficient of friction, 0.5; limit of square inch of pin = 50000; ultimate strength of crank-pin to cross $d = .04554 \sqrt{Apl}$; for $\frac{1}{16}$ deflection, $d = .0707 \sqrt{Apl^2}$.

7. An engine of 1,000 I. H. P. uses 20 pounds of steam per I. H. P. per hour; evaporate 8 pounds of water per pound of coal; revolutions, 60 per minute; temperature of injection water, 70°; temperature of discharge water, 100°; temperature of well, 110°; temperature of steam as it leaves the cylinder, 212°. Required, area of square feet of condensing surface; diameter of double-acting circular steam engine; diameter of single-acting feed-pump.

8. Indicator diagrams (Fig. 1) are taken from a pair of screw-engines working at right angles. Area of each piston, 2,000 square inches; revolutions per minute, 60; piston speed, 480 feet per minute. Weight of reciprocating parts, 4,000 lbs. Angularity of connecting-rod neglected. Find the greatest movement of the line-shaft.

$$Pa = \frac{.00034 WR^2 r \cos \theta}{A}$$

DEPARTMENT OF ASTRONOMY, NAVIGATION, SURVEYING.

NAVIGATION.

CADET-MIDSHIPMEN.

JANUARY, 1881.—Time allowed, five hours.

1. Write formulas to express the relations of the following, viz: (a) in plane sailing, of l , p , d , and C ; (b) in parallel sailing, of L , p , and D ; (c) in middle sailing, of D , d , C , and l ; and represent these relations graphically. Find the distance and distance between two places: (a) by a Mercator's chart; (b) by middle sailing, using Bowditch's tables; (c) by Mercator's sailing, using the tables.

2. Deduce formulas for finding the course, distance, and positions of the other points, upon the great circle joining two places.

3. Find the hour angle of a heavenly body when it is nearest to or on the vertical, considering three relative values of L and d ; and then the local mean time in the case of the sun, and in the case of a star, each bearing east.

4. Deduce formulas for finding the latitude from an altitude of a heavenly body observed at any time. What are ϕ , ϕ' , and ϕ'' , and what determines the sign? How is the altitude corrected, and the hour angle found, in the case of the sun?

5. Referring to question 4, find the effect upon the latitude of an error in altitude, and of an error in the time, and show in each case when the effect is greatest and when least.

6. Deduce the formula for the reduction to the meridian, and state how the latitude is found. $\sin 1'' = 0.00004848$. Explain the restrictions of this method.

7. January 1, the chronometer error is 1^h 23^m 37^s slow, and the daily rate is 1^s gaining. On March 2, the error is 1^h 22^m 01^s.5 slow, and the rate 1^s.1 gaining. Find the error on January 25 (to nearest 0^s.1).

8. Deduce the equation of equal altitudes. Explain the manner of observing the sun, and each subsequent step in order to find the error of the chronometer which mean time.

9. In the method of two altitudes of the sun for latitude, draw a figure showing the triangles in the order in which they are solved, noting the parts used and required in each. How is t found in case of a star being observed?

10. Find the position by Sumner's method, the ship having moved between the observations. What determines the interval which should elapse between observations of the same body? What is the use of a single line of position?

NAVIGATION.

CADET-MIDSHIPMEN.

JUNE, 1881.—*Time allowed, nine hours.*

1. What determines the selection of the principal stations of a survey? How is the astronomical bearing of a base-line determined by sextant and chronometer? Deduce the formulas.

2. Correct the collimation error in the bureau theodolite. Run in the shore-line between two stations, using a sextant.

3. To what plane should all soundings be reduced, and how is the reduction effected? How should you determine your position when sounding, and plot it on the chart? What must be your position with reference to the *great circle*, in order that a sounding may be accurately plotted?

4. Explain and illustrate by a figure the polyconic projection. Deduce the general equations of a meridian. State the characteristic features of the polyconic chart, and the advantages of the projection over the Mercator's projection for surveying purposes.

5. What is a running survey? What is an astronomical base? What is meant by "balancing the work," and how is it done?

$$6. \text{ Given } X' = X + aX + bY + cZ + P \dots\dots\dots (1)$$

$$Y' = Y + dX + eY + fZ + Q \dots\dots\dots (2)$$

$$Z' = Z + gX + hY + kZ + R \dots\dots\dots (3)$$

Explain what these equations represent, and the meaning of each term of the third equation.

7. Transform the first two equations so as to give the force of earth and ship to head, and the force of earth and ship to starboard, each in terms of the earth's horizontal force. Explain the further transformations to obtain the equation

$$\delta = A + B \sin \zeta' + C \cos \zeta' + D \sin 2\zeta' + E \cos 2\zeta'.$$

8. Explain each term of the preceding formula. Under what circumstances will A and E reduce to zero? What is the "starboard angle"? Find its value and the maximum value of the semicircular deviation in terms of the coefficients.

9. Explain the causes of the heeling error, and show in what direction it usually acts. Show how the heeling error may be corrected mechanically, placing the magnet at its proper distance from the compass.

10. Explain the construction and use of a Napier's diagram. Explain the practical correction of the semicircular deviation by the use of a single magnet, and by two magnets.

[One question may be omitted.]

Nine of the above having been discussed, extra credit will be given for answers to the following:

Extra question.

$$\text{Given } \frac{H'}{\lambda H} \sin \delta = A + B \sin \zeta + C \cos \zeta + D \sin 2\zeta + E \cos 2\zeta,$$

$$\frac{H'}{\lambda H} \cos \delta = 1 + B \cos \zeta - C \sin \zeta + D \cos 2\zeta - E \sin 2\zeta.$$

Deduce the equations of an epitrochoid, and then explain the construction of the dygogram which they represent. Explain, also, the construction of the dygogram as a limaçon.

Second day.

11. June 1, 1881. (a) Find the time of a.m. high water at Sandy Hook, in Long. 74° W. Establishment of port, $7^h 29^m$. (b) Same date, at Annapolis. Lat. $38^{\circ} 53'$ N., Long. $5^h 5^m 56.5$ W. Required, the local mean time of sunrise, supposing it to be the time it takes the sun to rise in altitude equal to its semi-diameter, the refraction, dip, &c. (c) Same date, at Annapolis. Find the local mean time when the star α Aquilæ (Altair) will be on the prime vertical east.

12. June 1, 1881, at Annapolis. Observed equal altitudes of the sun a.m. and p.m.: a.m. W. T. obs. $7^h 35^m 10^s$; a.m. C—W $3^h 25^m 0^s$; p.m. W. T. obs. $4^h 26^m 0^s$; p.m. C—W. $3^h 24^m 30^s$. Required, the error of chronometer on Greenwich mean time.

13. June 2, 1881. Lat. D. R. $25^{\circ} 0'$ S. Long. about $87^{\circ} 50'$ E. W. T. obs. $11^h 58^m 30^s$; C—W $5^h 50^m 20^s$; c. c. $+ 0^h 30^m 30^s$. Obs. alt. moon's lower limb $20^{\circ} 0'$ bearing NE'y. In. cor. $+ 2' 0''$. Height of eye, 20 feet. Time, about noon. Required, the longitude.

14. June 2, 1881. Lat. about 37° N. at about 8 p.m. W. T. obs. $5^h 08^m 06^s$; C—W $0^h 05^m 30^s$; c. c. $+ 4^h 32^m 49^s$. Obs. altitude of the star α Virginie (Spica) $42^{\circ} 41'$ bearing S'y. In. cor. $+ 2' 0''$. Height of eye, 20 feet. The Long. by obs. at 4 p.m. was $67^{\circ} 0'$ W., and the run from 4 p.m. until the time of this observation was 5 miles SE. (true). Required, the latitude by the circum-meridian altitude method.

Extra question, the above having been solved.

Adjust a transit instrument in azimuth.

$$\text{Given } r = b \frac{\cos(L-d)}{\cos d} + a \frac{\sin(L-d)}{\cos d} + \frac{c}{\cos d},$$

find the level, collimation, and azimuth constants. Having done so, how should you proceed to the exact determination of time?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY.

JANUARY, 1881.—Time allowed, four hours.

[Ten questions required.]

1. Define difference of potential. Electrical potential is one factor of energy; what is the other factor?

2. Prove mathematically that the capacity of a sphere removed from all conductors is equal to its radius. To what potential, if it were possible, must we charge a sphere of 1 metre in diameter, in order that its electrical density may be unity?

3. What is meant by the specific inductive capacity of a dielectric? How great a charge would a condenser take, with plates 1^m apart, of 1 square metre surface, and electrified by a thousand Daniel's cells, the plates being separated by gutta-serena specific inductive capacity 4.2? E. M. F. of each cell, .00974.

4. What couple is expressed by mIH ? At a magnetic station, the total magnetic intensity was 10.28 British units, and the inclination $68^{\circ} 9'$. What was H (horizontal intensity) in British units, also in C. G. S. units?

5. When the deflected needle of a tangent galvanometer is in equilibrium, what forces are acting upon it, and what are the expressions for their moments? Is it necessary that the needle should be highly magnetized or not? (Give reasons for answer.)

6. State Ohm's law. Derive formula for the arrangement of a battery to obtain greatest effect. Prove mathematically that in any given combination the maximum effect is obtained when the total resistance in the elements is equal to the resistance of the interpolar.

7. The current from 10 exactly similar cells, in series, produces a deflection of 8 in a tangent galvanometer, the external resistance of the circuit being 10 ohms. If

arranged so that there are 5 couples of 2 cells each, a deflection of $33^{\circ} 42'$ is produced. Required the internal resistance of a cell.

8. Explain the principle of Farmer's dynamo-electric machine, also the commutator. Make a drawing and explain fully the torpedo-firing key-board used in the service.

9. The current necessary to fire a torpedo fuze is .6 weber; the resistance of the fuze is 1 ohm, and that of the leading wires 2 ohms; what the smallest number of cells of E. M. F. 1.2 volts and $R=2$ ohms required to fire a torpedo, and how must they be arranged?

10. The poles of a battery, resistance 15 ohms, are joined by two wires in multiple arc; the first wire contains 2 fuzes of .5 ohm's resistance each, and leading wires 4 ohms; the second wire contains 4 fuzes of .5 ohm's resistance each, and leading wires 6 ohms. What must be the E. M. F. of the battery to fire all fuzes simultaneously, if it takes .5 weber to ignite a fuze?

11. Derive formula for the resistance of the shunted galvanometer. What part of C flows through the shunt, and what through the galvanometer? What is " U "? A certain galvanometer has a resistance of 246 ohms, and it is required to provide it with a $\frac{1}{10}$ th shunt; what must be the resistance of the shunt?

12. Define ϵ electro-chemical equivalent. A current from a battery of 70 Grove's cells in series was sent for 24 hours through an external resistance of 3,200 ohms. E. M. F. of each cell, 1.8 volts. $R=.9$ ohm. Required whole amount of zinc consumed in the entire battery during that time.

13. A short cable, 9 miles long, was laid across the lake, and its ordinary resistance was 81 ohms. On testing one morning A found that with B insulated the line gave 30 ohm's resistance; then B tested with A insulated, and found a resistance of 60 ohms. How far out from A must a boat go to get at the fault?

DEPARTMENT OF MECHANICS AND APPLIED MATHEMATICS.

STRENGTH OF MATERIALS.

CADET-ENGINEERS.

JANUARY, 1881.—*Time allowed, four hours.*

1. (a) A body weighing W pounds and moving with a velocity of V feet per second is connected with another body at rest and weighing W pounds, by a chain l feet in length and a square inches in sectional area; find the greatest stress on the chain, its inertia being neglected.

(b) In launching a ship a weight of five tons, intended as a drag, is attached to the ship by means of a chain 100 feet long and 8 square inches in effective sectional area; find the greatest pull on the chain, supposing the ship to have an inertia equivalent to that of a weight of 400 tons moving with the same velocity, and supposing this velocity to be 20 feet per second at the instant the drag begins to act, E being 25,000,000.

2. (a) Find the shortest rod that will bear without injury the shock occasioned by a weight of W pounds which falls through h feet before it begins to strain the rod, E , R , and the sectional area (a) in inches being given.

(b) Find l when $W=60$ pounds, $h=12$ feet, $E=30,000,000$ pounds, $R=15$ foot-pounds, and $a=0.25$ square inch.

3. (a) The principal stresses p and q being given, find the intensity and direction of the resultant stress on a plane inclined at an angle θ to the plane of greatest principal stress.

(b) Find r and γ , when $p=255$ pounds, $q=171$ pounds, and $\theta=27^{\circ}$.

4. (a) A cord suspended from two points not in the same vertical line sustains a uniform vertical load; find the equation of the curve in which the cord hangs, and the length of the arc measured from the vertex.

2. Derive Dr. Woolley's rule for computing volumes, and also his rule for moments.
3. Find general expressions for the moment of a wedge whose inclined faces are two water planes; first with reference to a vertical plane through its edge, and secondly with reference to one of its inclined faces.
4. The load-water line of a ship consists of a pair of sinusoids forward, and a pair of prolate cycloids aft, with a straight middle body; the length of the ship being l , and the length of the fore body l_1 , the length of after body $\frac{1}{2}l_1$, and the midship breadth b , find the coefficient of fineness.
5. Derive an expression for the height of a fixed metacentre. When the metacentre is not a fixed point, define the metacentric locus.
6. Define dynamical stability, and dynamical surface stability: derive an expression for each, and show that the former is the integral of the statical stability.
7. Prove that a vertical section of the surface of a rolling wave is a prolate cycloid; find the radii of the generating and of the rolling circles, and determine the point of inflexion.
8. Derive the formula for computing the augmented surface of a ship, and show how this formula may be employed to determine approximately the engine power necessary to give a ship the speed due to her length.
9. (a) Derive a formula for ascertaining the change of trim caused by moving a weight P a distance l , forward or aft.
(b) Determine the angle of maximum efficiency for a rudder, when the power applied is limited.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

INTERNATIONAL LAW.

MONTHLY EXAMINATION.

FEBRUARY, 1881.—*Time allowed, two hours.*

1. (a) Explain law, law of nature, international law, municipal law, public law, statute law, common law. (b) Explain the two phases of international law, (1) as an abstract system, (2) as a positive code.
2. State the essential points in the Monroe doctrine. Explain its origin, its authority, and its application. Discuss the correctness of the doctrine.
3. What are the three essential attributes of states, and in what does each of them consist? Show, with examples, how one or more of them may exist in a modified form.
4. Explain fully the relation of aliens to the government of the country in which they are residing.
5. State the circumstances in the case of the *Franconia*, and the conclusions reached in the English courts.
6. What are the jural rights, so called, that pertain to states; the moral claims? How far can the latter be said to form the grounds of international law?

INTERNATIONAL LAW.

MONTHLY EXAMINATION.

MARCH, 1881.—*Time allowed, two hours.*

1. State the extent of the exemption from local jurisdiction in foreign territory or in foreign ports of (1) foreign sovereigns, (2) foreign armies, (3) ships of war, (4) merchant vessels, (5) the crews of public or private vessels. What is the rule of law in France on this subject?

2. Name all the ship's papers required by international law. Describe those required by municipal law alone.

3. Explain the difference between a domiciled foreigner and a foreigner that has been naturalized. Define naturalization, expatriation, denizen (in England), *alien*. What change was made in the English law in regard to nationality in 1870?

4. Discuss the immunities of the residence of a diplomatic envoy.

5. State the duties of consuls.

6. State the reasons for beginning a war with a declaration. What is the rule of law as to (1) enemy's persons found in the country at the outbreak of war, (2) enemy's property, (3) private debts due to enemies, (4) public debts due to enemies?

INTERNATIONAL LAW.

MONTHLY EXAMINATION.

APRIL, 1881.—*Time allowed, two hours.*

1. Discuss the question whether the British proclamation of neutrality, in 1861, was an unfriendly act.

2. Define postliminy, salvage, *reldche forcée*, spy, *commercium belli*, special and general truce.

3. Name the four recognized restrictions upon neutral trade during war. What general power is given to belligerents in order to carry into effect these restrictions?

4. What is a privateer? State the usual restrictions placed by municipal law upon privateering. What ground was taken by the United States in regard to the clause of the Declaration of Paris relating to privateering, and what reasons may be assigned for the American position?

5. "When an internal war breaks out, the government must determine whether the municipal or the international code, in whole or in part, shall be adopted." Explain what is meant by the two "codes," give reasons for the adoption of either one, and the consequences flowing from it, as to belligerents and as to neutrals.

6. War between United States and Spain. In command of the U. S. S. *Trenton*, cruising in the Atlantic, you search the following vessels: (1) The Spanish brig *Carmen*, sailing to New York under a license from the United States consul at Cadiz; (2) the Spanish ship *Asturias*, bound to the same port, with olive-oil and hemp, under a license from the admiral commanding the squadron to which the *Trenton* belongs, to carry a certain quantity of hemp to New York; (3) the Norwegian bark *Olaf*, from Cadiz to Gottenburg, under a license from the Spanish government. Discuss the cases.

7. Later, you are lying in the roads of Brest, and a powerful Spanish iron-clad is lying outside. Late in the evening, as your steam-launch is bringing off the mail, she is surprised and captured by boats from the Spaniard. What will be the result? Some time after, the Spanish capture two American merchantmen. One of them, the *Anna*, is carried into Lisbon and condemned by a prize-court sitting there. The other, the *Rapid*, is carried into Bordeaux, and condemned by a prize-court in Barcelona. Both are sold to Frenchmen, and afterwards come, under the French flag, to Baltimore. The respective owners put in claims for the vessels. Discuss.

INTERNATIONAL LAW.

JUNE, 1881.—*Time allowed, three hours.*

[Starred questions are alternatives.]

1. Define international law, private international law. Define domicil, embargo, retorsion, rule of *uti possidetis*, exequatur, efficient blockade.

2. Explain naturalization, and state how it is obtained in the United States. Discuss the principles involved in the case of *Kosztka*.

3. Name the ship's papers required by both international and municipal law, and those required by international law alone. Describe any four of them.

4. State the principal arguments for and against the right of capture, during war, of private property at sea, as distinguished from private property on land.

4.* What is piracy by international law? How and where is it punishable? When the municipal law of a State enlarges the definition of piracy, to what persons does the enlarged definition apply, and where may they be tried? What considerations governed the cases of Confederate ships of war?

5. When does the State acquire title to a prize taken at sea? When may the title pass to individuals? What is the effect of this fact in the case of subsequent recapture of the prize? What limitations exist in regard to the nationality of a prize-court? in regard to the locality of the prize-court? in regard to the locality of the prize? What courts have jurisdiction of prize cases in United States? In England?

6. Classify the various kinds of contraband goods. How far is the destination of goods a test of their contraband character? State in full the distinctions drawn, as to ship and cargo, in adjudging upon a neutral the penalty for carrying contraband. Explain the doctrine of continuous voyages, as applied by the Supreme Court during the civil war.

6.* Explain in full the distinction between blockade *de facto* and blockade by notification. What two elements are necessary to complete the offense of breach of blockade? In what ways may this notice be given, or be presumed to have been given? State the rule in regard to notice laid down in the President's proclamation of 1861, and explain the interpretation that was put upon it.

7. (a) War between the United States and Spain. In command of the U. S. S. *Vandalia*, cruising in the Atlantic, you speak a vessel carrying German colors; you request her to heave to, but she continues on her course. What steps do you take? The German ship being brought to, she fires a volley of small arms into the boarding officer's boat as it approaches her. The search shows nothing of a suspicious character connected with the German vessel. What will you do, and what consequences will flow from your action? (b) Later, you fall in with a fleet of French merchantmen under convoy of a man-of-war of about your own strength. You attempt to search the merchantmen, when you are fired into by the man-of-war. Results? (c) You capture a Spanish brig near the Azores. You find that she is in an unfit condition to go to the United States, though she might be made seaworthy by being thoroughly repaired. She has a general cargo, with a large amount of specie. What course will you pursue, and what considerations will govern your decision? Supposing that the vessel were a neutral, carrying contraband, how would that affect the case?

8. (a) Later, you capture a Swedish brig, in the Bay of Biscay, carrying timber to Ferrol, where there is a Spanish dockyard. You find, on making search, that she had been previously captured by the *Kearsarge* and ordered to Savannah for adjudication; but that on the voyage the Swedish master and seamen overcame the prize, crew, set them adrift in the neighborhood of Brest, and renewed the original voyage. What would you do, and what consequences would flow from your act? Supposing that the original voyage were held to be innocent, how would that affect the case? (b) You overtake an Italian steamer, carrying Spanish troops from Cadiz to Havana. The master says his ship was seized by the authorities at Cadiz, and that he was compelled by force to undertake the voyage. You have every reason to believe his statement. Results? (c) Subsequently, the *Vandalia* is on blockade duty, the whole coast of Cuba being under efficient blockade. You search an English steamer heading for Santiago de Cuba. She had cleared from Liverpool for Vera Cruz with a cargo of rifles, saltpetre, and lead. The master states that he was putting into Santiago in distress, being out of water. He had previously made no attempt to speak the blockading squadron, and was only brought to after several shots. Results?

DEPARTMENT OF MODERN LANGUAGES.

SPANISH.

JUNE, 1881.—*Time allowed, three hours.**Translate the following in Spanish.*

1. Parlez-vous l'espagnol ?
2. Je le parle un peu.
3. Qui vous donne des leçons ?
4. C'est Monsieur X.
5. Combien de leçons par semaine vous donne-t-il ?
6. Seulement deux.
7. Ce n'est pas assez, mais vous avez une bonne prononciation.
8. Il faut bien travailler pour apprendre une langue.
9. Je suis le premier de ma classe.
10. Je le sais, vous étudiez beaucoup.
11. Savez-vous que nous étudions aussi la géographie et l'histoire en espagnol ?
12. Non, Monsieur, dites moi quelque chose de ce que vous savez.
13. Avec plaisir.
14. L'Espagne est un beau pays, elle se trouve divisée actuellement en quarantesept provinces. Celle de Madrid a deux cent vingt-cinq bourgs et villages.
15. Madrid capitale du royaume à 300,000 âmes, neuf théâtres, plusieurs fontaines, et de belles promenades.
16. Séville est une des plus belles villes de l'Espagne.
17. Charles premier a été proclamé roi d'Espagne en 1516, et peu de temps après empereur d'Allemagne sous le nom de Charles quint, lequel fut longtemps en guerre avec François premier, roi de France.
18. Vous racontez très-bien, vu qu'il y a si peu de temps que vous apprenez l'espagnol.
19. Vous êtes très aimable, car il n'y a que quatre mois que j'étudie l'espagnol.

Translate into French.

NAPOLEON AND WASHINGTON.

Napoleon had just been installed as First Consul, at the palace of the Tuileries, when everything still breathed the recollections of its ancient kings, when he learned the news of the death of Washington. The First Consul, to show his respect for the magnanimous character of the hero of the American Republic, announced his death to the consular guard and to all the troops of the French Republic in the following order of the day: "Washington is dead! This great man fought against tyranny: he established the liberty of his country. His memory must always be dear to the French people as well as to all free men of both worlds, and especially to the French soldiers who, like him and his American troops, fight in defense of liberty and equality. In consequence the First Consul has ordered that, for the space of ten days, black crepe shall be hung on all the colors and standards of the Republic."

FINAL EXAMINATION.

MAY, 1881.

CADET-MIDSHIPMEN—CLASS OF 1879.

NAVAL TACTICS.

Time allowed, three hours.

1. How should a fleet of 24 vessels be arranged, and how should the command be distributed? Where should the divisional and squadron commanders be found? Of what ships is the reserve division composed?

2. Give a diagram of the three formations of a fleet. State the order of battle for line, torpedo boats, and for broadside vessels. What is meant by the fleet being in line order, open order, and half distance when in line, and also in double column?
3. When is a fleet in natural order and when in reverse order? How is the guide vessel distinguished? In case the guide vessel is disabled what vessel takes her place? By whom is the rate of speed regulated, and what is known as steerage-way?
4. The fleet being in column of vessels, in natural order, form it into triple column.
5. The fleet being in double column, in natural order, form it into triple column.
6. The fleet being in columns of vessels abreast by divisions, heading north, change direction to the rear on any course from south to west.
7. The fleet under sail, close-hauled, what rules govern the speed and sailing of the fleet?
8. Change from columns of vessels abreast by division to a single column of vessels on the other tack, with the weather division leading.
9. How do you signal latitude and longitude and variation of the compass?
10. How do you signal a vessel's number? her private number?

SEAMANSHIP.

Oral—Specimen Questions.

I.

1. How do you let go a bower anchor? Describe fittings, &c.
2. Cut and fit lower mast-head pennants, wire rope.
3. As midshipman of the watch at night, you are ordered to see a second anchor ready for letting go; state how you would make the examination.
4. The ship being in irons, recover her on the old tack.
5. Riding to a coast current by the starboard anchor, wind four points on the starboard bow, weigh and stand out, the shore being close aboard on the port beam. (No tacking to be used.)
6. The weather sheet and clewline of maintop-sail being carried away, what is to be done?
7. Sailing-vessels meeting, wind S. by E., one steering N. by W., the other NNW., which has the right of way?

II.

- While at anchor in a strong tide, hoist a quarter-boat.
- Cut and fit topmast pennants, wire rope.
- Weigh a heavy anchor with a service launch.
- Set a jib, blowing fresh.
- Wind on the starboard quarter, all drawing sail set, you are struck by a squall; what do you proceed?
- Going before the wind, the mizzen topgallant parrel is carried away; what must be done?
- Sailing-vessels meeting, wind N., one steering ENE., the other W.; which has the right of way?

GUNNERY.

Time allowed, six hours.

- Define *explosion*. Upon what, in general, do the effects of explosion depend? What special circumstances modify the effects of explosion. Define *detonation*. What substance is usually employed in producing detonation, and upon what does its efficiency depend? Define *explosive mixture*, also *explosive compound*, and name the explosive bodies under each head, which are of practical value.
- State proportion of ingredients in United States Navy gunpowders. Classify the

different forms of gunpowder used in the Navy, according to the size of the vessel. For what are the large-grained powders used? Explain the principles governing the granulation of gunpowder.

3. What is a *system of rifling*? Explain how the rifled motion is given to a projectile. What systems of rifling are in general use?

4. What are the different kinds of strain to which a gun is subjected? What method of equalizing the strains is employed in the construction of heavy guns?

5. What considerations govern the distribution of a ship's crew at quarters? How are they distributed in relation to watches? How are they stationed at point broadside guns? turret guns? How are gun-captains selected? How are the riflemen organized and armed? firemen? wreck-clearers? sail trimmers?

6. Give the stations of a crew at a M. L. shifting pivot gun working with taffee men and a powderman. Give the titles on the right and left of the gun in the battery.

7. How is powder stowed in the magazine? Describe the arrangements for loading the battery with powder. Where should the scuttles be placed?

8. Draw and give nomenclature of VIII-in. M. L. R.

9. What fuzes are used in the service? Describe the Borman fuze.

THEORY OF NAVIGATION.

Time allowed, five hours.

1. (a) Adjust the horizon glass of a sextant. (b) Describe the azimuth circle of a Ritchie compass, and the manner of using it to find the compass bearing of a vessel. (c) State two ways of taking a departure, and note their relative accuracy. How is the entry in the log, in each case, and what use of the departure, should you make? Find the local mean time of sunset (disappearance of upper limb).

2. (a) Running parallel to the shore at a certain speed, how may its distance be found? (b) Given the compass bearing of the port, the speed of the ship, and by compass and hourly drift of the current, find the course to be steered. What is the chief source of error in taking an altitude of a heavenly body at sea horizon? (d)* Find the local mean time when a given bright star will be on the prime vertical east, and state the use of this knowledge.

3. (a) What is the three point problem? Show how it is solved by a geometric construction, and by a station pointer. (b) When you desire to observe the altitude of a bright star, how may its name be ascertained? (c) What is the most exact method, and what the usual method, of fixing an anchorage? What entry is made in the log in each case, and why? (d)* Find the great-circle course and distance between two places, by Napier's rules.

4. (a) Find the course and distance between two points on a Mercator's chart. Give the reasons for each. (b) Find the same by inspection of the tables (M. Sailing). (c) Adjust the azimuth plates of a theodolite in order that they shall be in a horizontal plane. (d) Measure a base-line with the means usually found on a ship.

5. (a) Obtain and plot soundings. (b) Describe the construction of a polyconic projection, and state its advantages for particular purposes. (c) Draw an astronomical triangle, and note the parts given and required in the $\phi''\phi'$ method for latitude. (d) If the sun, bearing SSE., how is the hour angle found?

6. (a) Show what ϕ , ϕ' , and ϕ'' mean, and how they are marked. (b) Using the bearing SSE., how is the hour angle found? (c)* In this problem, show analytically when the effect of an error in the hour angle will be greatest and when least. (d) Show the same graphically, upon the principle of Sumner's method.

7. (a) In Sumner's method, allow for an uncertainty in the chronometer correction. (b) Describe in detail, and noting all precautions, the observations for finding the error and rate of a chronometer by single altitudes of the sun, using:

* Formulas required.

social horizon. What are the advantages and disadvantages of this method? (c) Describe particularly the observations in the method of equal altitudes of the sun (a. m. and p. m.) for chronometer rate and error. What are the advantages and disadvantages of this method? (d)* Explain each quantity in the formula and each step in computing the chronometer error on Greenwich mean time.

8. (a) Explain the process of finding the deviations of the compass, either by bearings of a distant object, or by the plane-table method. (b) Explain the causes in iron ships of constant, semi-circular, and quadrantal deviation and heeling error. (c) Explain the construction and use of a Napier's diagram. (d) What is the effect of a change in the ship's position in magnetic latitude upon the semi-circular deviation, quadrantal deviation, and heeling error? and state with regard to any one of these why it is changed or is not changed.

9. (a) Explain the construction of the dygogram as a limaçon. (b)* What is the mean thread of a transit instrument? How are the equatorial thread intervals determined? (c)* Explain by a figure the reduction to the meridian, deducing Mayer's formula. (d) Describe briefly the parts of a zenith telescope.

[Question 9 is extra, and additional value will be given it, provided the others have been discussed.]

PRACTICAL NAVIGATION.

Time allowed, five hours.

Each cadet will take observations with the sextant and artificial horizon, as follows (questions 1 and 2):

1. One set of five altitudes of the sun for the chronometer error on G. M. T. and the error of the compass. The mean of the set must be used in the computation.

2. One set of five sights, using the sun and a chronometer whose error is known, for the astronomical bearing of an object upon the opposite bank of the Severn River. The height of the observer's feet above the sea level is 19 feet. The apparent altitude of the object must be found and considered. Distance [from the observer] of the shore line below and in the same vertical circle as the designated object, 3,300 feet. Use mean of observations.

3. May 20, 1881, at noon, Cape Race—Lat. $46^{\circ} 40' N.$, Long. $53^{\circ} 07' W.$ —bore by compass W. by N., distant 11 miles, the ship's head being NE., and the deviation for that course $17^{\circ} 0' E.$ Variation from chart, $30^{\circ} 0' W.$ Ship then sailed as follows until noon, May 21.

Compass courses.	Knots.	Winds.	Leeway.	Deviation.
E. S. E.	32.2	South.	7°	$13^{\circ} 0' E.$
S. E.	25.6	S. S. W.	8°	$5^{\circ} 0' E.$
S. E. by S.	32.8	S. W. by S.	6°	$2^{\circ} 45' E.$
S. by W.	25.7	S. E. by E.	8°	$8^{\circ} 30' W.$
N. E. by E.	31.8	do.	6°	$18^{\circ} 0' E.$
S. W.*	34.8	do.	None.	$9^{\circ} 15' W.$

* Run until noon from hour of morning time-sight, May 21.

May 21, 1881. Obs. merid. alt. $\odot 64^{\circ} 33' 50''$, bearing S. In. cor. $+1^{\circ} 30''$. Height of eye, 18 feet. Required, Lat. and Long. by D. R. at noon, May 21, 1881; Course and distance by D. R. from Cape Race; Lat. by observation.

4. About 7 a. m., May 21, 1881. W. T. obs. $7^h 01^m 23^s$, C-W. $7^h 03^m 12^s$, c. c. — $3^h 42^m 10^s$. Obs. alt. $\odot 20^{\circ} 16' 20''$. In. cor. $+1^{\circ} 30''$. Height of eye, 18 feet. Compass bearing of sun, N. $122^{\circ} 15' E.$ Ship's head NW. by W. Required, Long. at noon, May 21, 1881; deviation of the compass; set and drift of the current.

5. December 21, 1881, at Mauritius. Lat. $20^{\circ} 22' 36'' S.$; Long. $57^{\circ} 45' 42'' E.$ Equal

*Formulas required.

altitudes of the sun. A. m., Chro. T. obs. $3^h 30^m 51^s$; p. m., Chro. T. obs. $0^h 47^m$. Required, error of the chronometer on Greenwich mean time.

6. At 6 p. m., May 21, 1881, ship in South Atlantic, in Lat. $15^\circ 20' 30''$ S., the runs 90 miles SW. by S. by compass, the compass error being 1 point westerly, at about 4 a. m., May 22, 1881, the altitude of the moon, bearing easterly, is observed follows: W. T. obs. $4^h 02^m 13^s$, C-W. $2^h 9^m 15^s$, c. c. — $0^h 23^m 27^s$. Obs. alt. $25^\circ 20''$. In. cor. + $1' 30''$. Height of eye, 18 feet. Required, the longitude.

7. May 18, 1881, in morning twilight, in Long. $43^\circ 34' 17''$ W., observed altitude star μ Aquarii, as follows: W. T. obs. $3^h 38^m 42^s$. C-W. $6^h 02^m 24^s$, c. c. — $2^h 45^m 3$. Obs. alt. $\star 63^\circ 32' 20''$ bearing southward and eastward. In. cor. + $1' 30''$. Height eye, 18 feet. Required, the latitude.

8. May 19, 1881, about 4 a. m., in Long. $135^\circ 12' 18''$ E. W. T. obs. $4^h 1^m 12^s$, C-W. $3^h 3^m 33^s$, c. c. — $0^h 4^m 45^s$. Obs. alt. α Ursae Minoris (Polaris) $30^\circ 16' 10''$. In. cor. + $1' 30''$. Height of eye, 18 feet. Required, the latitude.

Which tide of the day will be the higher at Mauritius, Lat. $20^\circ 22' 36''$ S., Long. $54^\circ 42' 2''$ E., on May 19, 1881, and why? Find the time, the establishment being $1^h 30'$. Double weight is assigned questions 1 and 2.

[The weather being unfavorable, questions 1 and 2 were omitted, and 3 and 4 substituted for them.]

FRENCH.

Translate the following into French:

ALFRED THE GREAT, KING OF ENGLAND.

At a period when England was torn by civil wars, and a prey to the cruelty of the Danes, a man appeared, destined by Providence to avenge his country, to defend its rights, to enlighten the age in which he lived, and to adorn humanity. Alfred the Great was the fourth son of Ethelwolf, king of England; he succeeded to the throne on the death of his brother Ethelred, in the year 871. After several actions with the Danes, the unfortunate Alfred was obliged to seek his safety by flight, and to retire to the cottage of one of his peasants, where he remained several months as a servant. He afterwards withdrew to the isle of Athelney, in Somersetshire, where, having heard that the earl of Devonshire had obtained a great victory over the Danes, and had taken their magical standard, he disguised himself as a harper, entered the enemies' camp, and was admitted to the principal generals, who praised his talents for music. Having acquired an exact knowledge of the situation of his enemies, and finding that they were divided among themselves, he seized the favorable moment, joined the earl, headed his troops, surprised the Danes at Eddington, in Wiltshire, and obtained a complete victory.

Having secured the peace of his dominions, after a great number of battles which filled the enemies with terror, his next care was to police his kingdom. Although there remain but few of his laws, England owes to him many of those advantages which render her constitution so precious. The trial by jury is said to have been instituted by him. He caused learning to revive, and used his utmost endeavors to excite a love for letters among his subjects. He was himself a very learned prince, and all the hours he could take from business were devoted to study. When we consider the great qualities of Alfred, and his many virtues, we need not be surprised that his memory is still so dear to Englishmen.—Addison.

Translate the following into English:

AU RETOUR D'UNE LONGUE CAMPAGNE.

Un jour ou deux avant d'entrer, bien laver et nettoyer la peinture, surtout à l'intérieur du bâtiment et sous les cadènes; envoyer en bas les bouts-dehors de bonnettes par les raboter légèrement, les renvoyer en haut et peindre leurs bouts.

Un coup de pinceau sur les éraillures des canots ainsi que sur les tangons, les câbles.

les parées à mettre en place et si on est dans de bons parages, peindre l'extérieur aussi bas que possible, après l'avoir bien frotté.

Gratter les poulies mobiles de la mâture, etc., noircir les points de portage dans le grément.

Le matin qui précède l'entrée, briquer les ponts, nettoyer les manches à vent, l'armement et la voilure des canots.

Gréer des hamacs propres le soir précédent, s'il en est besoin réellement.

Briquer et mettre en ordre les échelles de commandement; raidir à nouveau les étais de mâts de perroquets, visiter les marques des bras et balancines.

A l'approche du port, enlever les paillets de brasseyage, remplacer les jarretières de mer par des jarretières de rade, ou bien si celles-ci sont à poste fixe sur l'envergure, les noircir à nouveau; dédoubler les amures et écoutes des basses voiles, dépasser les fausses cargues des huniers, s'assurer que les ancres et les câbles sont clairs, que l'orin de la bouée est paré, que la bouée est peinte en noir, que les chaînes sont bien dégagées et que rien ne pend en dehors.

Si on doit mouiller sous voiles, en approchant du mouillage, faire monter le monde pour diminuer de toile et ne pas oublier d'avoir un armement de canot prêt à pousser pour dresser les vergues aussitôt l'ancre au fond; les factionnaires du pont seront prêts à se rendre à leurs postes, les hommes à l'extérieur parés avec leur échafaud et leur peinture, à aller en dehors une fois les voiles serrées.

Mouiller l'ancre du vent en arrivant au point voulu, filer la chaîne jusqu'à bonne distance et fermer, charger ensuite les huniers et mouiller la seconde ancre, en embarquant du bon bord, pour ne pas faire de tours de chaîne et tenir bon jusqu'à ce qu'on vire la chaîne, afin de ne pas surpatter l'ancre.

Serrer les voiles et terminer l'amarrage du bâtiment.

LA NAVIGATION ANCIENNE.

Jusqu'à la fin du siècle dernier, le navigateur devinait, autant qu'il la calculait, la position de son navire. Les chronomètres si répandus aujourd'hui étaient alors à l'essai. Les éphémérides nautiques mêmes contenaient des fautes. Les instruments de navigation avaient des degrés d'erreur, car ces grossiers arbalètes, astrolabes, cercles marins, arcs de navigation, n'avaient pas encore fait place aux bons sextants et aux excellents cercles de nos jours. Les exemples ne manquent pas de navires qui, traversant l'Atlantique à cette époque, se trouvaient de six, huit et même dix degrés de longitude au delà de leur estime. Tel est à présent le degré de perfection des tables et des instruments de navigation, que le marin peut aujourd'hui découvrir, avec une grande certitude, tout courant qui coupe sa route.

Conversation entirely in French.

Subjects :

Mon dernier itinéraire. /

Une visite à bord d'un navire de guerre espagnol.

La force des différentes flottes étrangères.

Conversation avec un pilote français. Du poste des officiers pendant le combat. De la littérature étrangère, etc.



INDEX TO EXAMINATION PAPERS.

	Page.
Algebra , fourth class, Cadet-Midshipmen.....	77
Algebra , fourth class, Cadet-Engineers.....	77, 78
Analytical Geometry , third class, Cadet-Midshipmen.....	88
Analytical Geometry , third class, Cadet-Engineers.....	88
Astronomy , second class, Cadet-Midshipmen.....	101
Astronomy , second class, Cadet-Engineers.....	102
Boilers , first class.....	116
Calculus , second class.....	104
Calculus (elective), second class.....	106
Calculus (elective), third class.....	90
Chemistry , second class.....	103
Constitution of the United States , third class.....	92, 93
Curve Tracing (elective), fourth class.....	80
Descriptive Geometry , fourth class Cadet-Engineers.....	79
Descriptive Geometry , third class, Cadet-Midshipmen.....	89
Descriptive Geometry , third class, Cadet-Engineers.....	89
Designing Machinery , first class.....	117
Designing Machinery , second class, Cadet-Engineers.....	99
Electricity , first class.....	120
English and History , fourth class.....	81
French , fourth class.....	85
French , third class.....	96
French , second class.....	108
French , class of 1879.....	130
Geometry , fourth class, Cadet-Midshipmen.....	79
Gunnery , second class.....	98
Gunnery , class of 1879.....	127
Heat , second class.....	102
History , fourth class.....	81, 82
History , Naval, second class.....	108
History , Naval, third class.....	94, 95
Infantry Tactics , second class.....	98
Integral Calculus (elective), third class.....	90
International Law , first class.....	123, 124
Marine Engines , first class, Cadet-Midshipmen.....	113
Marine Engines , first class, Cadet-Engineers.....	115
Mechanics , second class.....	105
Mechanics (elective), second class.....	107
Method of Least Squares (elective), first class, Cadet-Engineers.....	122
Naval Architecture (theoretical), elective, first class.....	122
Naval History , second class.....	108
Naval History , third class.....	95, 96
Naval Tactics , second class.....	98
Naval Tactics , class of 1879.....	126
Navigation , first class, Cadet-Midshipmen.....	118, 119
Navigation , practical, class of 1879.....	129
Navigation , Theoretical, class of 1879.....	128

20

Ordnance and Armor, first class 11

Physics, third class, Cadet-Midshipmen 11

Physics, third class, Cadet-Engineers 11

Rhetoric, fourth class 11

Rhetoric, third class 11

Seamanship, third class, Cadet-Midshipmen 11

Seamanship, class of 1879 11

Seamanship, first class 11

Ship-Building, first class 11

Spanish (elective), second class 11

Spanish (elective), fourth class 11

Spanish, first class 11

Strength of Materials, first class, Cadet-Engineers 11

Theoretical Naval Architecture (elective), first class 11

Trigonometry, third class 11

○



